FOREST SITE CLASSIFICATION MANUAL

A Field Guide to the Damman Forest Types of Newfoundland

First Edition

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Front Cover: Ecoregion Map of Newfoundland, see page 6-3
for description.

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ABSTRACT

Forest management in Newfoundland, particularly with respect to forest renewal, has intensified considerably over the last decade. Currently, there is a need to: 1) Identify optimum sites for silvicultural treatments; 2) Decrease losses due to soil erosion and poor road construction practices; 3) Minimize losses to vegetation competition through preventive management; 4) Identify optimum tree species to site matching; 5) Identify potential conflicts with other forest users through the environmental assessment process.

This manual is intended to complement these needs by providing a forest site classification system based on the natural relationships between forest vegetation and soils. Such a system, because it identifies nutrient and moisture relationships between component forest types, can be used to predict successional trends following disturbance by logging, fire and insect infestation.

The manual includes a vegetation and soil key to 33 forest types. The key is cross referenced to 90 botanical illustrations and color photos to aid in plant identification. Fact sheets for each forest type provide a brief description of stand composition and soil characteristics followed by the following interpretations: productivity, succession, harvesting sensitivity, trafficability, suitability for road construction, natural regeneration, species suitability for artificial regeneration, frost heave hazard, windthrow hazard and vegetation competition hazard. The ecoregions and subregions of Newfoundland are described and selected toposequences are illustrated to show the position of the forest types at the landscape level.

Currently, the level of site-specific data in Newfoundland only supports the development of very general silvicultural prescriptions. This manual is intended to provide an initial site classification framework within which the results of research experiments and practical experience can be extrapolated to provide site-specific silviculture prescriptions and related growth and yield information.

RÉSUMÉ

A Terre-Neuve, l'aménagement des forêts, le reboisement surtout, a pris une importance considérable durant la dernière décennie. Les priorités actuelles sont les suivantes: 1) Déterminer les sites les plus favorables au traitement sylvicole; 2) Réduire les portes causées pas l'érosion et la construction routière mal gérée; 3) Par un aménagement préventif, minimiser les pertes dues à la concurrence entre végétaux; 4) Déterminer quelles espèces d'arbres conviennent le mieux aux sites choisis; 5) Grâce au processus d'évaluation du milieu, prévoir les conflits possibles avec les autres utilisateurs de la forêt.

Ce manuel a pour but de répondre à ces besoins en offrant un système de classification des sites basé sur les relations naturelles entre la végétation et le sol des forêts. Comme un tel système distingue divers types de forêts en termes de relations entre substances nutritives et humidité, il peut être employé pour prévoir l'évolution des peuplements suite aux dommages causés par l'exploitation forestière, les feux de forêts ou les insectes.

Le manuel contient une clé d'identification des peuplements végétaux et des sols pour 33 types de forêts. Cette clé renvoie à 90 dessins botaniques et photos en couleurs facilitant l'identification des espèces végétales. A chaque type de forêt correspond une fiche technique donnant une brève description du peuplement et du sol, suivie des indications suivantes: productivité, succession, sensibilité aux récoltes, tolérance à la circulation, adaptabilité à la construction routière, régénération naturelle, propriété des espèces à la régénération artificielle, risques de gel, de déracinement par le vent et de concurrence par d'autres espèces végétales. Les régions et sous-régions écoclimatiques de Terre-Neuve y sont définies et identifiées, et un choix d'illustrations de toposéquences montre l'emplacement des types forestiers selon le niveau du terrain.

Actuellement, les données spécifiques sur les différents sites terre neuviens ne rendent possibles que des recommandations sylvicoles d'un ordre très général. Ce manuel entend fournir un cadre initial de classement des sites à partir duquel les résultats de recherches et d'expériences pratiques peuvent être appliqués à des sites spécifiques de façon à fournir conseils sylvicoles et renseignements divers sur la croissance et le rendement.

TABLE OF CONTENTS

Page

Acknowledgements iii

Abstract iv

Résumé v

List of Figures xiii

List of Tables xv

1. Introduction 1-1

2. Management Interpretation of Forest Types 2-1

3. Keys to the Forest Types 3-1

   Balsam Fir Forest Types 3-7
   Black Spruce Forest Types 3-17
   Black Spruce Fen Types 3-21
   Kalmia-Black Spruce Forest Types 3-25
   Hardwood Forest Types 3-29
   Hardwood Thickets and Heath Types 3-33

4. Fact Sheets 1-33 4-1

   (#1) Equisetum-Rubus-Balsam Fir 4-2
   (#2) Rubus-Balsam Fir 4-4
   (#3) Clintonia-Balsam Fir 4-6
   (#4) Taxus-Balsam Fir 4-8
   (#5) Dryopteris-Hylocomium-Balsam Fir 4-10
   (#6) Dryopteris-Balsam Fir 4-12
   (#7) Dryopteris-Rhytidiadelphus-Balsam Fir 4-14
   (#8) Dryopteris-Lycopodium-Balsam Fir 4-16
   (#9) Hylocomium-Balsam Fir 4-18
   (#10) Gaultheria-Balsam Fir 4-20
   (#11) Pleurozium-Balsam Fir 4-22
   (#12) Sphagnum-Black Spruce 4-24
   (#13) Black Spruce-Feathermoss/Bedrock 4-26
   (#14) Black Spruce-Feathermoss/Very Dry 4-28
   (#15) Black Spruce-Feathermoss/Dry 4-30
   (#16) Black Spruce-Feathermoss/Bog 4-32
   (#17) Black Spruce-Feathermoss/Moist 4-34
   (#18) Carex-Black Spruce 4-36
   (#19) Osmunda-Black Spruce 4-38
   (#20) Kalmia-Black Spruce 4-40
   (#21) Cladonia-Kalmia-Black Spruce 4-42

(#22) Nemopanthus-Kalmia-Black Spruce 4-44
(#23) Sphagnum-Kalmia-Black Spruce 4-46
(#24) Birch-Aspen 4-48
(#25) Dryopteris-Clintonia-Birch 4-50
(#26) Mountain Alder-Birch 4-52
(#27) Rubus-Birch 4-54
(#28) Dryopteris-Birch 4-56
(#29) Kalmia-Birch 4-58
(#30) Galium-Mountain Maple 4-60
(#31) Lycopodium-Alder Swamp 4-62
(#32) Birch Thickets 4-64
(#33) Kalmia Heath 4-66

5. Soil Characteristics 5-1

6. Landscape Relationships 6-1

Western Newfoundland Ecoregion 6-2
Central Newfoundland Ecoregion 6-11
North Shore Ecoregion 6-13
Northern Peninsula Ecoregion 6-16
Avalon Forest Ecoregion 6-17
Maritime Barrens Ecoregion 6-20
Eastern Hyper-Oceanic Barrens Ecoregion 6-27
Long Range Barrens Ecoregion 6-27
Strait of Belle Isle Ecoregion 6-27

7. Plant Identification 7-1

Plant Illustrations 7-3

Shrubs

(1) *Acer rubrum* L. 7-4
(2) *Acer spicatum* Lam. 7-5
(3) *Alnus crispa* (Ait.) Pursh 7-6
(4) *Alnus rugosa* (DuRoi) Spreng. 7-7
(5) *Cornus stolonifera* Michx. 7-8
(6) *Kalmia angustifolia* L. 7-9
(7) *Ledum groenlandicum* Oeder 7-10
(8) *Nemopanthus mucronata* (L.) Trel. 7-11
(9) *Rhamnus alnifolia* L'Her 7-12
(10) *Rhododendron canadense* (L.) Torr. 7-13
(11) *Ribes glandulosum* Grauer 7-14
(12) *Ribes hirtellum* Michx. 7-15
(13) *Ribes lacustre* (Pers.) Poir. 7-16
(14) *Ribes triste* Pall. 7-17
(15) *Rubus idaeus* L. 7-18

(16) *Sambucus pubens* Michx. 7-19
(17) *Taxus canadensis* Marsh. 7-20
(18) *Vaccinium angustifolium* Ait. 7-21
(19) *Vaccinium ovalifolium* Smith 7-22
(20) *Viburnum cassinoides* L. 7-23
(21) *Viburnum edule* (Michx.) Raf. 7-24
(22) *Viburnum trilobum* Marsh. 7-25

Dwarf Woody Plants

(23) *Epigaea repens* L. 7-26
(24) *Gaultheria hispidula* (L.) Bigel. 7-27

Ferns

(25) *Athyrium filix-femina* (L.) Roth 7-28
(26) *Dryopteris disjuncta* (Ledeb.) C. V. Mort. 7-29
(27) *Dryopteris noveboracensis* (L.) Gray 7-30
(28) *Dryopteris phegopteris* (L.) Christens. 7-31
(29) *Dryopteris spinulosa* (O.F. Mull.) Watt 7-32
(29) var. *typicum* (O.F. Mull.) Watt 7-33
(30) var. *americana* (Fisch.) Fern. 7-33
(31) var. *intermedia* (Muhl.) Underw. 7-33
(32) *Osmunda cinnamomea* L. 7-34
(33) *Pteridium aquilinum* (L.) Kuhn 7-35

Fern Allies

(34) *Equisetum sylvaticum* L. 7-36
(35) *Lycopodium annotinum* L. 7-37
(36) *Lycopodium lucidulum* Michx. 7-38

Grasses

(37) *Calamagrostis canadensis* (Michx.) Nutt. 7-39
(38) *Cinna latifolia* (Trev.) Griseb. 7-40
(39) *Deschampsia flexuosa* (L.) Trin. 7-41
(40) *Glyceria canadensis* (Michx.) Trin. 7-42

Sedges

(41) *Carex flava* L. 7-43
(42) *Carex leptonervia* Fern. 7-44
(43) *Carex trisperma* Dew. 7-45

Forbs

(44) *Actaea rubra* (Ait.) Willd. 7-46
(45) *Aralia nudicaulis* L. 7-47
(46) *Aster puniceus* L. 7-48
(47) *Caltha palustris* L. 7-49
(48) *Circaea alpina* L. 7-50

(49) *Clintonia borealis* (Ait.) Raf. 7-51
(50) *Coptis groenlandica* (Oeder) Fern. 7-52
(51) *Cypripedium reginae* Walt. 7-53
(52) *Galium kamtschaticum* Steller 7-54
(53) *Galium triflorum* Michx. 7-55
(54) *Geum rivale* L. 7-56
(55) *Goodyera repens* (L.) R. Br. 7-57
(56) *Habenaria dilatata* (Pursh) Hook. 7-58
(57) *Listera convallarioides* (Sw.) Nutt. 7-59
(58) *Listera cordata* (L.) R. Br. 7-60
(59) *Mitella nuda* L. 7-61
(60) *Moneses uniflora* (L.) Gray 7-62
(61) *Rubus chamaemorus* L. 7-63
(62) *Rubus pubescens* Raf. 7-64
(63) *Sanguisorba canadensis* L. 7-65
(64) *Senecio aureus* L. 7-66
(65) *Smilacina trifolia* (L.) Desf. 7-67
(66) *Solidago macrophylla* Pursh 7-68
(67) *Solidago rugosa* Ait. 7-69
(68) *Streptopus amplexifolius* (L.) DC 7-70
(69) *Streptopus roseus* Michx. 7-71
(70) *Viola cucullata* Ait. 7-72
(71) *Viola incognita* Brainerd 7-73

Mosses

(72) *Campylium polygamum* (BSG) C. Jens 7-74
(73) *Dicranum majus* Sm. 7-75
(74) *Dicranum polysetum* Sw. 7-76
(75) *Dicranum scoparium* Hedw. 7-77
(76) *Hylocomium splendens* (Hedw.) BSG 7-78
(77) *Hylocomium umbratum* (Hedw.) BSG 7-79
(78) *Mnium punctatum* Hedw. 7-80
(79) *Pleurozium schreberi* (Brid.) Mitt. 7-81
(80) *Ptilium crista-castrensis* (Hedw.) DeNot. 7-82
(81) *Rhytidiadelphus loreus* (Hedw.) Warnst. 7-83
(82) *Rhytidiadelphus squarrosus* (Hedw.) Warnst. . . . 7-84
(83) *Rhytidiadelphus triquetrus* (Hedw.) Warnst. 7-85
(84) *Thuidium recognitum* (Hedw.) Lindb. 7-86
(85) *Sphagnum girgensohnii* Russ. 7-87
★(86) *Sphagnum russowii* Warnst. 7-87
(87) *Sphagnum magellanicum* Brid. 7-88
★(88) *Sphagnum papillosum* Lindb. 7-88
(89) *Sphagnum nemoreum* Scop. 7-89
(90) *Sphagnum quinquefarium* (Lindb. ex
Braithw.) Warnst. 7-90
(91) *Sphagnum squarrosum* Crome 7-91

Lichens

(92) *Cladonia alpestris* (L.) Rabenh. 7-92
(93) *Cladonia arbuscula* (Wallr.) Rabenh. 7-93
* (94) *Cladonia mitis* Sandst. 7-93
* (95) *Cladonia rangiferina* (L.) Wigg. 7-93

Plant Photographs 7-95

Glossary 8-1

References 9-1

Appendices . . . .

A. Index to Abbreviations Used in the Fact Sheets A-1

B. Index to Common Names of the Plant Species B-1

* not illustrated, but short description and color photograph included.

LIST OF FIGURES

Page

1. Legend to vegetation type symbols. 2-2
2. Legend to soil profile symbols. 2-3
3. Successional trends following fire and cutting. 2-5
4. Criteria used to determine the relative frost heave hazard. 2-20
5. Criteria used to determine the relative windthrow hazard. 2-22
6. Areas of Newfoundland covered by soil series maps. 5-2
7. Soil texture groupings and field methods used to determine soil texture. 5-10
8. Procedure for field identification of soil texture. 5-11
9. Distribution of forest types with respect to soil moisture and soil fertility. 5-12
10. Ecoregions and subregions of Insular Newfoundland. 6-3
11. Distribution of forest types on calcareous bedrock - Western Newfoundland Ecoregion. 6-5
12. Distribution of forest types on hilly topography with shallow soil over shale - Western Newfoundland Ecoregion. 6-6
13. Distribution of forest types on rolling topography with deep till - Western Newfoundland Ecoregion. 6-7
14. Distribution of forest types on rolling topography witn till derived from gneiss, granite, sandstone, or quartzite - Western Newfoundland Ecoregion. 6-9
15. Distribution of forest types on deep, coarse textured glacial till - Western Newfoundland Ecoregion. 6-10

Figure Page

16. Distribution of forest types on medium textured till - Central Newfoundland Ecoregion. 6-12

17. Distribution of forest types on coarse textured till- Central Newfoundland Ecoregion. 6-14

18. Distribution of forest types on loam to silty loam textured, nutrient-rich till - Central Newfoundland Ecoregion. 6-15

19. Distribution of forest types on limestone bedrock, characteristic of the Beaver Brook Limestone Subregion - Northern Peninsula Ecoregion. 6-18

20. Distribution of forest types on parent materials derived from sandstone, characteristic of Ten Mile Pond in the Beaver Brook Limestone Subregion - Northern Peninsula Ecoregion. 6-19

21. Distribution of forest types on ribbed moraine - Avalon Forest Ecoregion. 6-21

22. Successional relationships between forest and heath types following increase in anthropogenic fire frequency - Maritime Barrens Ecoregion. 6-23

23. Distribution of forest types on rolling topography with shallow till, characteristic of the Northern Barrens Subregion - Maritime Barrens Ecoregion. . . . 6-24

24. Distribution of forest types on undulating topography, characteristic of the Southeastern Barrens Subregion - Maritime Barrens Ecoregion. 6-25

25. Distribution of forest types on hilly topography, characteristic of the valley systems in the Southeastern Barrens Subregion - Maritime Barrens Ecoregion. 6-26

LIST OF TABLES

Page

1. Summary of Canada Land Inventory (CLI) forest capability classes, subclasses and approximate yields. . . . 2-7
2. Summary of references and related information used to estimate site index of the forest types. 2-8
3. Soil compaction hazard levels. 2-11
4. Relative erodibility levels based on pedologic and geomorphic conditions. 2-13
5. Harvesting sensitivity levels based on erodibility, slope and groundwater. 2-14
6. Relative trafficability levels based on soil condition and slope. 2-15
7. Road suitability levels based on trafficability and CLI class. 2-17
8. Summary of forest types, abbreviations and fact sheet numbers. 3-2
9. General diagrammatic key to forest and thicket cover types. 3-7
10. Diagrammatic key to subdivisions of the Balsam Fir forests. 3-13
11. Diagrammatic key to the Balsam Fir-Herb Rich forest types. 3-14
12. Diagrammatic key to the Balsam Fir-Fern Rich forest types. 3-15
13. Diagrammatic key to the Balsam Fir-Black Spruce-Moss Rich forest types. 3-16
14. Diagrammatic key to the Black Spruce forest types. 3-20
15. Diagrammatic key to the Black Spruce fen types. . . . 3-24

Table page

16. Diagrammatic key to the Kalmia-Black Spruce forest types. 3-28

17. Diagrammatic key to the Hardwood forest types. 3-32

18. Diagrammatic key to the Hardwood thickets and heath types. 3-37

19. Peat decomposition scale. 5-5

20. Abbreviations used in the soil profile descriptions. 5-6

21. Soil moisture regime scale. 5-9

INTRODUCTION

Forest management in Newfoundland and Labrador has intensified considerably over the last 10-15 years with a corresponding increase in the demand for wood and diversification of wood uses. At the same time, losses from fire, insect and diseases and other land uses have created a challenge for forest managers to increase sustained yield on a smaller land base. Also, increased sophistication in resource allocation and land use planning now requires closer scrutiny of forest management plans for potential impacts on other users of the forest resource. In the future, forest managers and their field personnel will require more detailed information on the natural attributes of forest habitats and how they react to forest management and disturbance by fire, cutting and insect infestations.

It is in this context that a site manual has been developed to bridge the gap between forestry applications and forest ecology research. The user should fully appreciate that our understanding of forest ecosystems relative to our management ambitions is incomplete. The classification presented in this manual provides basic information on the composition of 33 forest types, their relative productivity, sensitivity to disturbance and successional trends. The management interpretations are tentative, primarily because of a lack of site specific information, particularly as it relates to site preparation and the growth of managed forests. Hopefully, the manual will provide the means and also inspire the need for collection of site specific information in the future. If this purpose is achieved, subsequent approximations of the forest classification should provide considerably greater interpretive content. In the interim, the site classification presented in this manual should provide a framework for researchers and operational foresters to share the results of experiments and experience using a common terminology for site type.

Approach

The forest site classification presented in this manual was developed by Dr. A.W.H. Damman who worked with the Canadian Forestry Service from 1956 to 1967. Only the merchantable forest types and non-forest vegetation occupying potentially merchantable site types are included in this manual. Unfortunately, only the central Newfoundland work (Damman 1964) was published in a readily available format. Western Newfoundland (Damman 1967) and northern Newfoundland (Damman 1963) forest site classifications are unpublished. The eastern Newfoundland classification initiated by Damman was later completed by Meades (1986) which to date is also restricted in distribution. For more detailed information on non-forest vegetation types and vegetation synthesis tables providing the complete floristic structure and composition of the vegetation, the user is referred to these original sources.

The Damman classification approach emphasized the use, where possible, of vegetation as an indicator of differences in soil moisture and fertility between forest sites. Vegetation types were combined with soil types at various levels of abstraction to define forest types. The vegetation was classified using the Zurich-Montpellier School of Phytosociology, more currently described as the réléve method (Muller-Dombois and Ellenberg 1974). Differential species and dominance are used to define the vegetation types. A combination of soil subgroup, parent materials, texture and moisture regime are used to characterize the soil types associated with each of the forest types. The Black Spruce-Feathermoss forests display a wide range of productivity and successional trends within a very homogeneous vegetation type. Soil characteristics alone are used to divide this vegetation type into five distinct forest types.

In addition to classifying the forest vegetation, Damman provided predictions concerning the successional relationships between types and their response to disturbance by fire and logging. This was accomplished by documenting the natural relationship between forest types and topography and then observing successional trends in disturbed and undisturbed landscapes. Also, by comparing changes in floristic composition, structure and topographic relationships between climatic regions, he generated an ecoregion map of Newfoundland (Damman 1979, 1983).

Subsequent to Damman's work, several mensurational studies were undertaken on selected forest types throughout insular Newfoundland (Bajzak 1962, Bajzak et al. 1968, Page et al. 1970, and Page and van Nostrand 1970). The results of these studies have been used to provide site indices for selected forest types. Damman's classification was also used as a basis of site classification in the Canada Land Inventory Capability Classification (Delaney 1974) and several bio-physical land classification projects adopted this forest type classification (Wells et al. 1972, Wells and Roberts 1973, Roberts and Bajzak 1984).

Manual Structure

Chapter 4 represents the central core of this manual providing 33 facts sheets that describe the most commonly encountered forest types in Newfoundland. The fact sheets also provide forest management interpretations for succession, productivity, harvesting and silviculture.

Chapter 2 provides an explanation of all of the characteristics given in the fact sheets including data sources and rationale, underlying each of the forest management interpretations. The purpose of this chapter is to provide the user with sufficient understanding of the management interpretations to make an independent judgement of how well the fact sheets describe any particular site under appraisal.

For those unfamiliar with the Damman forest type classification, Chapter 3 provides a traditional dichotomous key to the forest types arranged according to six general forest cover types. Instructions for the use of the key are provided in the introduction to Chapter 3. The keys are followed by diagnostic tables which serve to summarize the most important differences in vegetation, soil and productivity that are used to define the forest types.

The Damman forest site classification relies heavily on the use of vegetation to differentiate forest types. For users inexperienced in plant identification, each species used in the key to forest types is cross-referenced to the plant illustrations and photographs in Chapter 7.

Soil characteristics are also an essential feature of the forest type classification. A brief description of the soil taxonomy and related terminology, textural categories and moisture regime scales are given in Chapter 5.

Although the geographical dimension of Newfoundland is small, there is a high degree of variability in its environment. Chapter 6 provides a brief summary of how variations in climate, parent materials and relief effect the distribution of forest types in the landscape. Toposequences are used to illustrate representative landtypes and to provide the user with an appreciation of the potential variability that can be expected at a scale appropriate to forest operations.

A glossary of technical terms, a list of cited references and two appendices complete the manual. Appendix 1 is a list of abbreviations used in the fact sheets. Appendix 2 is an index to the common names of the plants.

CHAPTER 2

MANAGEMENT INTERPRETATION OF FOREST TYPES

INTRODUCTION

The forest type fact sheets in Chapter 4 provide a concise summary of stand structure, site conditions, succession, productivity and management interpretations for harvesting and silviculture. The fact sheets portray representative site conditions under which each forest type is most frequently encountered in the field. Similarly, the schematic landscape relationships illustrated in Figures 11-25 (Chapter 6) show an idealized relationship between forest vegetation, soils and topography at the landscape level. In nature, there are numerous exceptions to these generalizations. For example, slope summits are usually assumed to represent dry, nutrient-poor sites. However, if for some reason a ridge is capped with a thin veneer of loamy till, then the forest growth may exceed that of middle or lower slopes with a coarser texture.

Because of such exceptions, all of the interpretations presented in this manual should be critically evaluated relative to a specific site being assessed. To encourage such evaluation, this chapter provides all criteria and assumptions used to derive the management interpretations given in the fact sheets. These criteria, in combination with the soil characteristics described in Chapter 5, should be adequate for the user to develop an independent site appraisal. The following discussion describes the content of the fact sheet from top to bottom and explains the rationale for harvesting and silvicultural interpretations.

HABITAT FEATURES

Stand Structure: The stand structure diagrams are used to provide a simple visual portrayal of the tree species composition, relative crown closure and dominant understory plants. A legend for species composition is provided in Figure 1. The symbols given in brackets after the forest type name are those used in the landscape diagrams (Figures 11-25, Chapter 6).

Soil Profile: The soil profiles are derived from field descriptions taken in the development of the forest site classification. Figure 2 provides a legend to conventions used in the soil profile diagrams. The profiles selected for illustration were

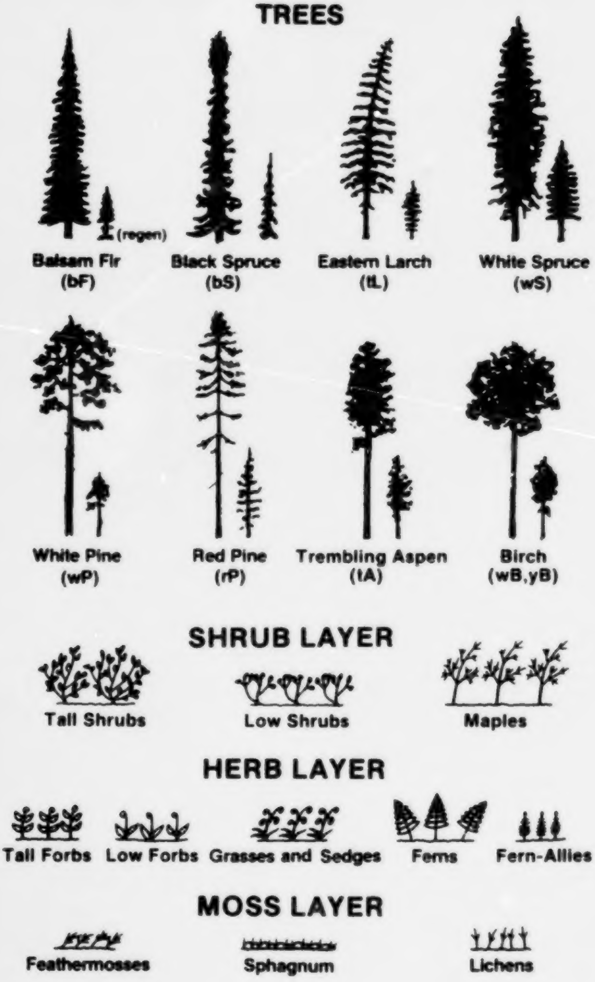

TREES
(regen)
Balsam Fir
(bF)
Black Spruce
(bS)
Eastern Larch
(tL)
White Spruce
(wS)
White Pine
(wP)
Red Pine
(rP)
Trembling Aspen
(tA)
Birch
(wB,yB)
SHRUB LAYER
Tall Shrubs
Low Shrubs
Maples
HERB LAYER
Tall Forbs
Low Forbs
Grasses and Sedges
Ferns
Fern-Allies
MOSS LAYER
Feathermosses
Sphagnum
Lichens

Figure 1. Legend to vegetation type symbols.

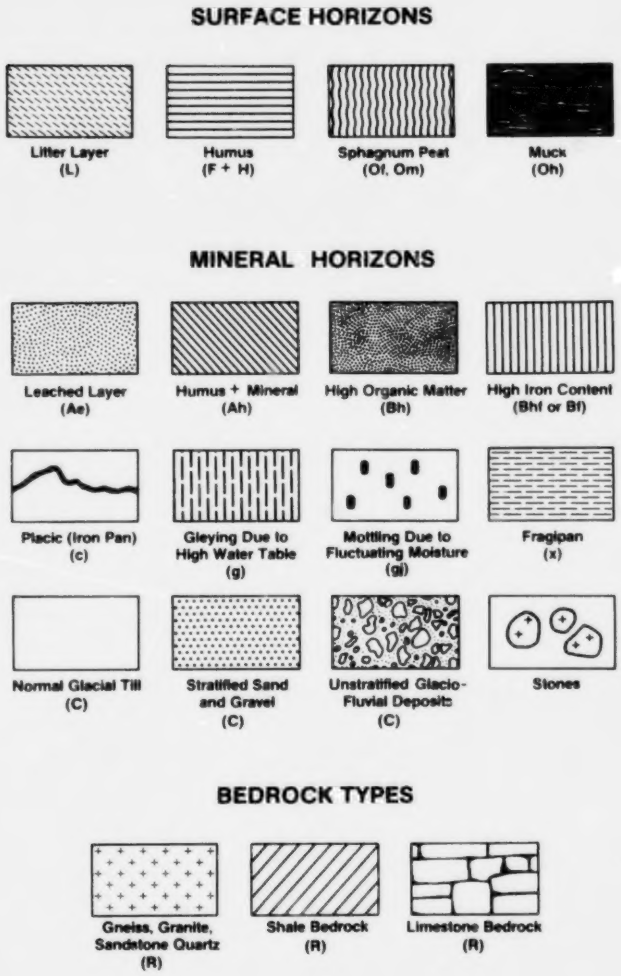

SURFACE HORIZONS
Litter Layer (L)
Humus (F + H)
Sphagnum Peat (Of, Om)
Muck (Oh)
MINERAL HORIZONS
Leached Layer (Ae)
Humus + Mineral (Ah)
High Organic Matter (Bh)
High Iron Content (Bhf or Bf)
Placic (Iron Pan) (c)
Gleying Due to High Water Table (g)
Mottling Due to Fluctuating Moisture (gi)
Fragipan (x)
Normal Glacial Till (C)
Stratified Sand and Gravel (C)
Unstratified Glacio-Fluvial Deposits (C)
Stones
BEDROCK TYPES
Gneiss, Granite, Sandstone Quartz (R)
Shale Bedrock (R)
Limestone Bedrock (R)

Figure 2. Legend to soil profile symbols.

considered to be representative for that forest type, however, a wide variation in the sequence and depth of various soil horizons can be expected even within a local area.

Edaphic Grid: The edaphic grid is a graph showing the range of soil moisture and soil fertility over which a particular forest type is expected to occur. The moisture regime scale and fertility evaluation are discussed in Chapter 5. There is a general relationship of increasing forest productivity with increasing fertility, but this relationship deteriorates with extremes of moisture and stand density. Also, near the coast and near treeline, climate tends to override edaphic conditions as a determinant of growth.

Site Conditions: The site conditions provide a summary of the range of topography, soil texture, organic horizon, rooting zone and pH expected for each forest type.

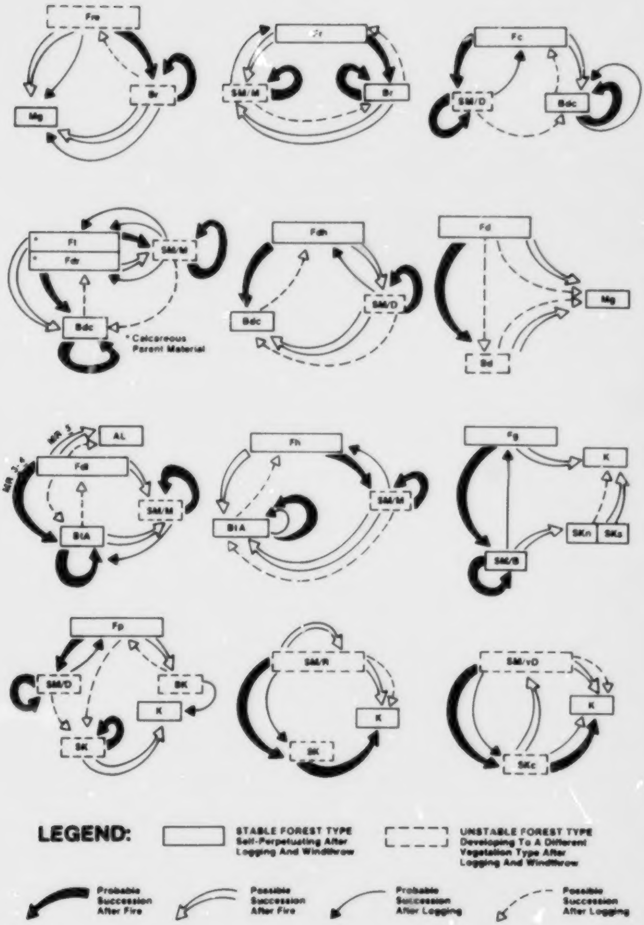
Soil Types: The subgroup level of the Canadian System of Soil Classification (1978) is used to provide the range of soil profiles usually associated with each type. This information may be useful in correlating forest types with soil series maps. Chapter 5 provides a list of subgroups and the conventions used in soil profile description as well as the areas covered by soil series maps (Figure 6).

Succession: The trend in forest composition following disturbance by cutting and fire is suggested by indicating which forest type will occupy a site assuming adequate softwood stocking. In general, Balsam Fir forest types are self-perpetuating after logging, insect mortality and blowdown, whereas Black Spruce forest types occupy a site following fire (Figure 3). Predictions assume a time period of approximately 100 years. Thus, long term trends such as the gradual replacement of hardwood stands to softwoods over several rotations are not considered in this discussion.

The term NSR (not sufficiently restocked) is used in the traditional context to suggest what type of vegetation will occupy a site if softwood regeneration is less than 2500 stems per hectare or approximately 40% stocking. This condition most commonly occurs under one of the following circumstances:

1. Following cutting in pure Black Spruce stands with less than 50 Balsam Fir seed trees per hectare well distributed throughout the stand.

2. Following fire in pure Balsam Fir stands lacking 50 well distributed Black Spruce seed trees per hectare. This problem is particularly prevalent in moist maritime forests that do not have a natural fire history.


Fm
Mg
Br
Fr
SM/M
Br
Fc
SM/D
Bdc
Ft
Fdr
SM/M
Bdc
* Calcareous Parent Material
Fdh
Bdc
SM/D
Fd
Mg
Sd
MR 3
MR 3, 4
AL
Fdl
SM/M
BtA
Fh
BtA
SM/M
Fg
K
SKn
SKs
SM/B
Fp
SM/D
BK
K
SK
SM/R
K
SK
SM/vD
K
SKc
LEGEND:
STABLE FOREST TYPE Self-Perpetuating After Logging And Windthrow
UNSTABLE FOREST TYPE Developing To A Different Vegetation Type After Logging And Windthrow
Probable Succession After Fire
Possible Succession After Fire
Probable Succession After Logging
Possible Succession After Logging

Note: For forest type abbreviations, see Table 8 (page 3-2) or Appendix A.

Figure 3. Successional trends following fire and cutting.

3. Black Spruce stands that have been salvage cut following several years of severe budworm infestation. The Eastern Spruce Budworm selectively feeds on flowers, and thereby, reduces potential cone crops (Schooley 1980). In most cases, this is not a problem in Balsam Fir stands because of the tendency of Balsam Fir to establish as advance regeneration.

4. Fire, cutting or insect mortality in immature stands that have not produced an adequate cone crop.

In general, regeneration failure is most commonly associated with dry, nutrient-poor sites or moist nutrient-rich sites with a dense understory of herbs and/or ferns. On the poor sites ericaceous shrubs such as *Kalmia angustifolia* (6), *Ledum groenlandicum* (7), *Rhododendron canadense* (10), and *Vaccinium angustifolium* (18) form a dwarf shrub *Kalmia* Heath (#33).

Nutrient-rich sites most frequently develop to Birch Thickets (#32) and subsequently hardwood forest types. On sites with surface seepage waters Mountain Maple Thickets (#30) and Alder Thickets (#31) can develop where tree growth would normally be very productive.

Productivity Estimate: The Canada Land Inventory (CLI) project established a capability classification for forest land in Newfoundland using the classes and subclasses given in Table 1. The Damman site classification system was used to integrate productivity assessment and mapping in Newfoundland (Beanlands and Damman 1972, Delaney 1974). The yields given in Table 1 represent what would be expected from normally stocked softwood stands in a 60 year rotation period. These yields probably underestimate considerably what might be produced from a managed stand on any particular site type. At the present time, there is no data base from which to estimate yields of managed stands with reference to specific forest types.

Site index at breast height age of 50 years was estimated using two approaches. For forest types included in the Canadian Forestry Service regional mensurational studies, the site index was estimated from height age curves. Table 2 provides a summary of site indices by region and forest type. The references for all data except CLI class and subclass are cited by region in the table. The CLI data is from Delaney (1974).

The site index for forest types not sampled in regional mensurational studies is estimated by extrapolation from sampled forest types having a similar position in the edaphic grid. These values occur only in the last column-EST (estimate) of the productivity table and apply

Table 1. Summary of Canada Land Inventory (CLI) forest capability classes, subclasses and approximate yields.

Capability Class	Merchantable Volume		Mean Annual Increment		Major Subclasses
	m³/ha	Cords	m³/ha/yr	ft³/ac./yr	
2	> 386	> 65	> 6.3	> 90	C
3	297-386	50-65	5.0-6.3	71-90	FM
4	214-291	36-49	3.6-4.9	51-70	FW
5	131-208	22-35	2.2-3.5	31-50	MFW
6	48-125	8-21	0.8-2.1	11-30	FMWU
7	< 41.5	< 7	< 0.7	< 10	FMPRIU

SUBCLASSES

Except for Class 1, subclasses indicate the kind of limitation for each class. The subclasses are as follows

CLIMATE

Denotes a significiant adverse departure from what is considered to be the median climate of the region, that is, a limitation as a result of local climate, adverse regional climate will be expressed by the class level

SUBCLASS C - a combination of more than one climatic factor or when it is not possible to decide which of two or more features of climate is significant

SUBCLASS U - exposure

SOIL MOISTURE

Denotes a soil moisture condition less than optimum for the growth of commercial forests but not including inundation

SUBCLASS M - soil moisture deficiency

SUBCLASS W - soil moisture excess

PERMEABILITY AND DEPTH OF ROOTING ZONE

Denotes limitations of soil permeability or physical limitation to rooting depth

SUBCLASS D - physical restriction to rooting by dense or consolidated layers other than bedrock

SUBCLASS R - restriction of rooting zone by bedrock

OTHER SOIL FACTORS

Denote factors of the soil which, individually or in combination, adversely affect growth

SUBCLASS E - actively eroding soils

SUBCLASS F - low fertility

SUBCLASS I - soils periodically inundated by streams or lakes

SUBCLASS P - stoniness which affects forest density or growth

SUBCLASS S - a combination of soil factors, none of which, by themselves would affect the class level but cumulatively lower the capability class

Table 2. Summary of references and related information used to estimate site index of the forest types.

Forest Type (Age Class)	No. of Plots	Trees Per Ha	% Hardwood Stems	* MSV m ^{3}/ Ha	** CLI	*** SI $_{50}$ (B.h.) m		
						bF	bS	wS
NORTHERN								
1. Page et al. 1970								
Taxus-bF (55-70) Typical Subtype	9	2674	3.4	243.6	5MR-5S	10.7		
Dryopteris-bF (101+)	22	1616	14.0	159.2	3F-4F	9.2		
Clintonia-bF (101 +)	29	1836	3.7	168.2	3M-4M	7.9		
Rubus-bF (101+)	13	1750	6.1	154.3	3S-4S	11.5		
Pleurozium-bF (101 +)	17	2688	1.5	103.3	5MF	6.7	6.7	
WESTERN								
2. Bajzak et al. 1968								
Dryopteris-Rhytidiadelphus-bF (70-85)	7	1396	7	263.6	3S-4S	15.2	13.1	
Dryopteris-bF (56-71)	14	1253	15	230.5	2C	16.8	15.2	
Hylocomium-bF (60-75)	14	3380	9	228.4	4F-5FM	12.8	12.0	12.0
Dryopteris-Hylocomium-bF (55-67)	26	2068	4	209.1	3M-4M	15.2	13.1	
Taxus-bF (93-120) Epigaea Subtype	13	2810	4	114.1	5MR	7.6	5.5	6.4

*MSV - Merchantable Softwood Volume. **CLI - Canada Land Inventory Class and Subclasses. *** Site Index at Breast Height Age 50 years.

Forest Type (Age Class)	No. of Plots	Trees Per Ha	% Hardwood Stems	* MSV m³/ Ha	** CLI	*** SI_{50} (B.h.) m		
						bF	bS	wS
CENTRAL								
3. Bajzak 1982								
Pleurozium-bF (50-80)	32	4025	2	212.4	5MF	11.6		12.1
Hylocomium-bF/ Podzol (50-80)	28	4178	4	228.7	4FM-5FM	11.1		12.1
Hylocomium-bF /Seepage (50-80)	28	6455	4	215.1	4F	13.0	11.0	
Rubus-bF (50-80)	27	2853	5	283.8	4w-3w	13.1		13.0
Dryopteris-Lycopodium -bF (Wet)(50-80)	25	1325	15	198.6	3w	13.0		13.0
Dryopteris-Lycopodium-bF (Typical) (50-80)	25	1190	10	285.7	2C-3F	13.9		
Black Spruce on Sandy Loam (40-60)	35	5352	13	152.1	5MF	11.8		
EASTERN								
4. Page and van Nostrand 1970								
Dryopteris-bF (50-71)	7	1072	22	94.0	4F	13.1		
Clintonia-bF (42-63)	6	4774	12	179.2	5F	11.9	9.2	
Hylocomium-bF (42-53)	8	5783	7	185.9	5F	11.9	11.1	
Pleurozium-bF (34-49)	6	6536	17	188.4	5MF	11.6	9.5	
Rubus-bF (42-59)	10	4727	28	111.9	4S	10.8		10.5
Kalmia -bS (42-58)	26	6804	10	114.1	6MF	10.6		9.7

*MSV = Merchantable Softwood Volume. **CLI = Canada Land Inventory Class and Subclasses. *** Site Index at Breast Height Age 50 years.

collectively to all softwoods. Data for all Eastern Larch (tL) and Red Pine (rP) are from Roberts and van Nostrand (1984) and Roberts (1988) respectively.

Generally speaking, site specific information is lacking for many forest types and the productivity data should be considered an estimate only. The authors have no means at this time to assess whether or not regional site index and yield curves are adequate for current management objectives. The values in Table 2 represent the best estimates currently available for site index on a site specific basis.

HARVESTING INTERPRETATIONS

This section includes interpretations relative to developing effective forest harvesting systems while at the same time minimizing impacts to other resources and maximizing benefits to future silvicultural operations and future yield. One of the single most important site factors governing most interpretations is slope. Unfortunately, the forest types defined in this manual override, to some extent, slope classes significant to interpreting hazard levels for harvesting sensitivity, trafficability and road construction. Therefore, harvesting interpretations, with the exception of compaction, have been made for each forest type within a specific slope class. Slope classes outside the normal range of the forest type have not been evaluated.

The overall impact of harvesting can only be truly assessed in the context of the total area harvested. At this level, mapping systems, such as developed by van Kesteren (1986), provide the best means to portray land units in a spatial context to each other and to quantify the areas affected. The interpretations given in this manual are intended to complement such an approach, not to replace it.

The season of harvest, type of machinery and operator skill can override site factors as variables controlling the amount of ground disturbance associated with harvesting. In the following interpretation, it is assumed that operations will occur during periods when the soil is not frozen and soil moisture content is average for any particular forest type. Most sites having high hazard levels can be readily operated with a lower hazard when the soil is frozen.

Compaction Hazard
(after Corns and Annas 1986)

The degree of soil compaction is influenced by a number of soil physical properties, including texture, structure, percentage and type of coarse fragments, percentage of organic matter and organic layer thickness (Boyer 1979). Table 3 shows compaction hazard levels.

Table 3. Soil compaction hazard levels (modified from Boyer 1979).

SOIL TEXTURE	% COARSE FRAGMENTS	THICKNESS OF ORGANIC LAYER	SOIL STRUCTURE	CHARACTER OF COARSE FRAGMENTS	COMPACTION HAZARD LEVEL
SAND LOAMY SAND	< 35 - > 60	0-40 cm	WEAK - STRONG	ANG & RND[1]	L
SANDY LOAM CLAY LOAM LOAM SILT LOAM SILT SILTY CLAY LOAM	< 35	< 5 cm	WEAK - MOD.[2]	ANG & RND	H
			STRONG	ANG & RND	M
		5-40 cm	WEAK - MOD.	ANG & RND	H
			STRONG	ANG & RND	M
	35 - 60	< 5 cm	WEAK - MOD.	ANG & RND	M
			STRONG	ANG & RND	L
		5-40cm	WEAK - MOD.	ANGULAR	L
				ROUNDED	M
			STRONG	ANG & RND	L
	> 60	0-40 cm	WEAK - MOD.	ANG & RND	L
SANDY CLAY LOAM SANDY CLAY SILTY CLAY CLAY	< 35	< 5 cm	WEAK - MOD.	ANG & RND	H
			STRONG	ANG & RND	M
		5-40 cm	WEAK - MOD.	ANG & RND	H
			STRONG	ANG & RND	M
	≥ 35	0-40 cm	WEAK - STRONG	ANG & RND	L
ORGANIC SOILS	N/A[3]	> 40 cm	N/A	N/A	H

[1] ANG = ANGULAR RND = ROUNDED [2] MOD. = MODERATE [3] N/A = NOT APPLICABLE

Compaction reduces porosity and rate of water infiltration but increases physical impedence to growing roots (Pritchett 1979). The horizon that gives the most severe rating in the upper 30cm of mineral soil will determine the rating for the soil.

Increased soil compaction has been shown to reduce forest productivity in many parts of the world. Quantitative data is not yet available for our area. Soil compaction can be minimized by keeping heavy machinery off the more susceptible soils when they are wet, minimizing the area of logging roads on clearcuts, and minimizing the number of passes over an area (Rothwell 1978). On susceptible soils, most compaction occurs during the first pass over the area by heavy equipment. Compaction effects can be long lasting.

Under some conditions, the surface 10-20cm of compacted soil will recover within a few years to a few decades. The deeper soil compaction appears to require substantially longer periods, and the rate of recovery is still largely unknown.

Winter logging and site preparation minimizes compaction, and the desirability of restricting summer operations to well-drained, coarse textured soils is emphasized. Soil compaction effects are discussed further in reviews by Froehlich (1973) and Lull (1959).

Harvesting Sensitivity (after van Kesteren 1986)

The harvesting sensitivity rating is derived from a combination of erodibility, slope and groundwater condition. This sensitivity rating was developed primarily for mapping the environmental sensitivity of land to forest harvesting operations. This system predicts relative impact assuming the amount of soil exposure (humus removal) is equal between types being compared. The levels given in the fact sheets represent those that would be expected if the forest type were occupying its normal topographic position as illustrated in Figures 11-25 in Chapter 6. Therefore, the user should carefully assess the slope, soil texture and groundwater conditions to determine if there is a significant departure from that described in the fact sheet.

A detailed presentation of the rationale and parameters used in harvesting sensitivity appraisal can be found in van Kesteren (1986).

Table 4 defines the four levels of erodibility used to assess harvesting sensitivity and summarizes the general relationship between soil texture and the genetic category of the surficial deposit.

The slope and groundwater classes used to assess harvesting sensitivity are defined as follows:

Slope Class - (S)

S_0 - Negligible (0-5%)
S_1 - Low (6-15%)
S_2 - Moderate (16-30%)
S_3 - High (31-45%)
S_4 - Very High (46-60%)
S_5 - Extreme (>60%)

Groundwater Class - (G)

G_0 - No predominant groundwater influence in soil profile

G_1 - Lateral seepage of soil water (interflow)

G_2 - Perched or true groundwater influence in soil profile

G_2(i) - Class G_2 with periodic inundation

Table 4. Relative erodibility levels based on pedologic and geomorphic conditions.

Relative Erodibility	Particle Size Class[1] or Field Texture[2] (Symbol)	Genetic Category[3]	Probable Textural Classes and (Inclusions)
E0 (none)	Consolidated bedrock Unconsolidated rock Blocky (angular, size > 256 mm) (a) Bouldery (rounded, size > 256 mm) (b) Rubbly (angular, size 2-256 mm) (r) Gravelly (rounded, size 2-256 mm) (g)	Rock Alluvial	Consolidated bedrock and unconsolidated rock; non soil: unconsolidated mineral and/or organic materials 10 cm in depth a, b, r, g
E1 (low)	Coarse sand (cos) Sand (s) Fine sand (fs) Very fine sand (vfs)	Alluvial Aeolian Glacio-Fluvial Morainal	cos, s, fs, vfs (g, b) cos, s, fs, vfs cos, s, fs, vfs (g, b) cos, s, fs, vfs (r, a)
E2 (moderate)	Loamy coarse sand (lcos) Loamy sand (ls) Loamy fine sand (lfs) Loamy very fine sand (lvfs) Coarse sandy loam (cosl) Sandy loam (sl) Fine sandy loam (fsl) Very fine sandy loam (vfsl) Organic (o) fibric (of)	Alluvial Glacio-Fluvial Morainal Colluvial Organic	lcos, ls, lfs, lvfs (g, b) lcos, ls, lfs, lvfs (g, b) lcos, ls, lfs, lvfs, cosl, sl, fsl, vfsl (r, a) lcos, ls, lfs, lvfs, cosl sl, fsl, vfsl (r, a) of
E3 (high)	Loam (l) Silt loam (sil) Silt (si) Sandy clay loam (scl) Fine sandy clay loam (fscl) Very fine sandy clay loam (vfscl) Clay loam (cl) Silty clay loam (sicl) Sandy clay (sc) Silty clay (sic) Clay (c) Heavy clay (hc) Organic (o) mesic (om) humic (oh)	Morainal Colluvial Alluvial Lacustrine Marine Aeolian Organic	l, sil, scl, fscl, vfscl, cl, sicl, sc, sic, c (r, a) l, sil, scl, fscl, vfscl, cl, sicl, sc, sic, c (r, a) l, sil, si (g, b) si, c (cos, s, fs, vfs) si, sc, sic, c, hc (cos, s, fs vfs) l, sil, si om, oh

[1] C.S.S.C. 1978.
[2] Day 1982
[3] Wells et al. 1972.

To derive the harvesting sensitivity levels, first compare slope class and relative erodibility level in the upper portion of Table 5. Then compare this erodibility + slope class level to the groundwater class in the lower portion of Table 5. This will give you the following harvesting sensitivity levels:

0 - None
1 - Low
2 - Moderate
3 - High
4 - Very High
5 - Extreme

Forest types with a 0 or 1 rating will generally display a high degree of resilience to harvesting in the sense that levels of stream siltation, amount of ground disturbance, soil movement and gullying should be relatively low, whereas, a 4 or 5 rating would be expected to have high levels of siltation and ground disturbance.

Table 5. Harvesting sensitivity levels based on erodibility, slope and groundwater.

SLOPE CLASS	SOIL ERODIBILITY CLASS			
	E_0	E_1	E_2	E_3
S_0	NONE	NONE	LOW	MODERATE
S_1	NONE	LOW	LOW	MODERATE
S_2	NONE	LOW	MODERATE	MODERATE
S_3	NONE	MODERATE	MODERATE	HIGH
S_4	NONE	HIGH	HIGH	HIGH
S_5	NONE	VERY HIGH	VERY HIGH	VERY HIGH

GROUNDWATER CLASS	SOIL ERODIBILITY CLASS + SLOPE CLASS				
	NONE	LOW	MODERATE	HIGH	VERY HIGH
G_0	0	1	2	3	4
G_1	0 – 1	2	3	4	5
$G_2^{(i)}$	0 – 1 (2)	2 – (3)	3 – (4)	4	5

Trafficability

Trafficability refers to the properties of the forest type with respect to its inherent capacity to support efficient operation of off-road harvesting equipment. Skidders and harvesters with conventional tires are assumed to be the primary target of this interpretation. Although indirectly related to concerns such as erosion and compaction, this is not intended to be an enviromnental interpretation. These interpretations are based on summer logging with average soil moisture content for that forest type. All forest types will have a relatively high operability when frozen, although snow depth may introduce constraints. In general, forest types with low trafficability levels and covering extensive areas can be more efficiently operated under winter conditions. Table 6 provides the basic criteria used in assessing each site's level of trafficability. Slope is an overriding factor in machinery efficiency. Organic soils have hard-

Table 6. Relative trafficability levels based on soil condition and slope.

	SLOPE (%)			
Soil Condition	0-15	16-30	30-60	60^+
Organic Soils Depth ≥ 50 cm MR $\bar{6}$ - $\bar{8}$	O	O	O	O
Gleysols ± Muck Surface W.T. ≤ 30 cm MR $\bar{5}$ - $\bar{6}$	M	L	L	L
Gleyed Podzol or Regosol SL-CL W.T. 30-50 cm MR $\underline{3}$ - $\underline{4}$	H	M	M	L
Orthic Podzol Coarse Textured W.T. ≥ 50 cm MR 0 - 2	H	H	M	L

MR = Moisture regime
W.T. = Water table
SL = Sandy loam
CL = Clay loam

O = None
L = Low
M = Moderate
H = High

ly any supporting capacity. Heavy textured soils with high groundwater tables or seepage have a low rating, whereas coarse textured soils without surface moisture have a high rating. The predicted levels of trafficabilty are as follows:

O - Machinery cannot be supported for more than one or two passes on the same surface.

Low - Machinery can be supported but with poor traction and high risk of down time.

Moderate - Machinery can be supported with reduced traction but little risk of getting stuck.

High - Machinery should be able to run efficiently with slope as the only constraint on performance.

Road Location

Numerous factors influence the location of logging roads including the distribution of forest productivity in the landscape, the availability of road materials, occurrence of rivers and large water bodies, etc. Ideally, roads should be located such that drainage is good, **wood volume/kilometre of road** is maximized and the amount of forest land removed from production is minimized. Such an ideal situation rarely occurs in practice because the most productive forest types occur on moist, steep slopes covering extensive areas, allowing for little flexibility in routing. Thus, in many cases, roads, by necessity, may have to be situated on sites with a low location rating. Table 7 shows the tradeoff between productivity and trafficability used in rating each forest type with respect to road location. It is primarily intended for decision making when circumstances provide for a choice in routing. Additional guidelines for road location can be found in van Kesteren (1986) and McCubbin *et al*, (1985).

SILVICULTURAL INTERPRETATIONS

Species Suitability

This interpretation attempts to categorize the biological suitability of potential tree crops for specific forest types. Economics and future product demands are not considered as criteria although some allowance has been made to diversify the species composition of plantations from the status quo. Susceptibility to insect infestations or disease is not considered a criteria assuming that adequate protection will be provided to all plantations. The interpretations are generally biased towards pulpwood production. Wood form and dimension are strongly affected by factors other than that in-

Table 7. Road suitability levels based on trafficability and CLI class.

Trafficability	FOREST CLI CLASS		
	2-3	4-5	6-7
High	L	M	H
Moderate	L	M	M
Low	L	L	L

L=low M=moderate H=high

cluded in this manual, i.e. provenance, local climate, spacing, etc.

In the case of larch and pine, no attempt has been made to distinguish between species because of a general lack of site specific baseline data. For the other species, the general site requirements given in Fowells (1965) are contrasted with the moisture regime, pH and nutrient status of each of the forest types to categorize the species into one of the following suitability groups:

Most Desirable (MD)

Tree species identified in this category are considered the best suited to the site in terms of survival and growth.

Satisfactory (S)

Species in this category will produce merchantable forest stands on a given forest type at rates that are acceptable but less than for species in the most desirable category.

Least Desirable (LD)

Species in this category will produce the lowest growth rates and may not produce merchantable stands on the given forest type within a 50 year rotation. Species in this category should not be planted on the forest type in question.

Yellow Birch shows a distinct southern distribution pattern in Newfoundland (Damman 1965, 1976). Planting of this species should be restricted to the Western Newfoundland Ecoregion south of Deer Lake and in the Avalon Forest Ecoregion at elevations below 200m.

Natural Regeneration Potential

The natural regeneration potential of the forest types is assessed following fire and cutting assuming levels of seed supply, ground scarification, species mortality, etc. are equal. The predictions follow most of the assumptions outlined in the previous section on succession. Ratings of high, moderate and low have been indicated along with the species most likely to dominate.

Low - Regeneration may be less than that needed for optimum site occupancy. Succession to an NSR situation occurs with a high level of frequency.

Moderate - Regeneration will be between 2,500 and 10,000 stems per hectare ensuring adequate levels of stocking. Thinning may or may not be required depending on management objectives.

High - Regeneration will probably exceed 10,000 stems per hectare necessitating thinning in intermediate stages of rotation (10-50 years) for optimum growth.

Vegetation Competition

Usually vegetation competition does not present a problem on sites that are fully stocked to softwoods if tree growth is synchronous with competing species. On sites where regeneration is inadequate or delayed due to remoteness of a suitable seed source, certain plants can gain a competitive advantage over softwood trees. This is the situation on most NSR sites where softwood regeneration is lacking or severely stunted. It may also be the case in stands where insects have selectively removed the softwood component of a mixed wood stand and the regeneration is overtopped by hardwoods. The plant species that constitute a vegetation management problem change with gradients in moisture and nutrients and from one ecoregion to another. The table given in the fact sheet identifies the species which could potentially pose a competition problem and the relative level of competition as follows:

Low - Competition from the species in question may cause some growth restraint in the early years of development (0-5 yrs) but no greater than that experienced by natural regeneration in the normal course of stand development.

Moderate - Competition from the species in question will seriously retard softwood regeneration and may cause regeneration time lags of up to 10 years. However, succession to fully stocked softwood stands should not be seriously impaired.

High - Competition from the species in question will seriously impair establishment and growth of natural regeneration. Residual softwoods display suppressed height growth and relatively low ratios of needles to branch. Succession to cover types other than softwood is probable without vegetation management.

X - Significant competition not anticipated on a site.

Symbols used in the Vegetation Competition table given in the fact sheets are as follows:

wB - White Birch
pC - Pin Cherry
A - Speckled Alder
K - *Kalmia angustifolia* and other ericaceous shrubs
tA - Trembling Aspen
mM - Mountain Maple
G-S - Grasses and Sedges
R - Raspberry

Frost Heave Hazard

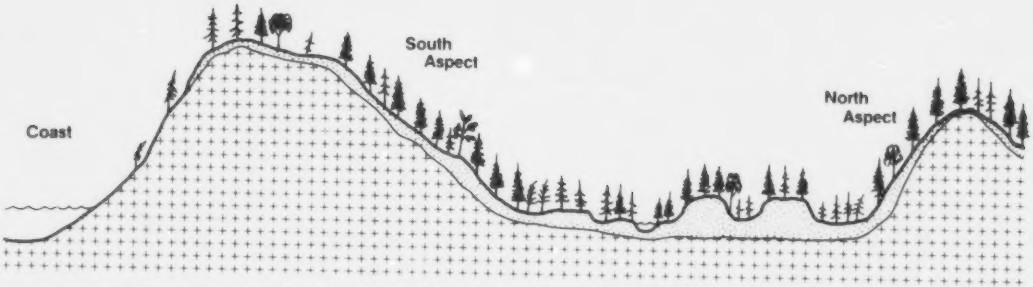
Frost can cause direct damage to new foliage and/or through soil freeze-thaw activity uproot planted seedlings. Frosts are usually more severe at some distance from the coast in topographic positions that impede air circulation. Thus, in the fact sheet, uplands, slopes and valleys are considered to represent distinct landscape positions where frost heave hazard for a specific forest type might differ.

Frost heaving of the soil tends to increase with soil moisture which in turn is related to texture. Thus, coarse textured sites are considered to be less prone than fine textured sites. The humus horizon moderates soil-frost distrubance as does deep snow cover. The intermittent nature of snow cover on the coast and exposed ridge tops in the Maritime Barrens Ecoregion promotes intense soil frost activity. In general, heavy scarification of the humus is not recommended on sites that have a high frost heave hazard.

The relationship between topographic position and soil moisture in defining high (H), moderate (M) and low (L) levels of frost heave hazard in the fact sheets is illustrated in Figure 4.

Windthrow Hazard

Windthrow hazard is also strongly controlled by the interaction of landscape position and soil moisture regime (Figure 5). Blowdown is most common where winds are strongest and soils are wet. Wet soils are characterized by deep organic layers and shallow rooting. Shallow till, compacted soil



Topographic Position	Coastal Upland		Slope		Valley			Hummock Complex				Slope	Upland
Snow Cover[1]	S		M		D			S	D	S	D	D	S
Soil Texture[2]	C	M	M	C	H	C	M	M	H	M	H	M	C
Moisture Regime[3]	1-2	3-4	2-3	1-2	4-5	1-2	2-3	2	3-4	2	3-4	3	1-2
Frost Heave Hazard	M	H	M	L	H	L	M	L	H	L	H	M	L

[1] Snow Cover: S=Shallow M=Moderate D=Deep

[2] Texture: C=Coarse M=Medium H=Heavy

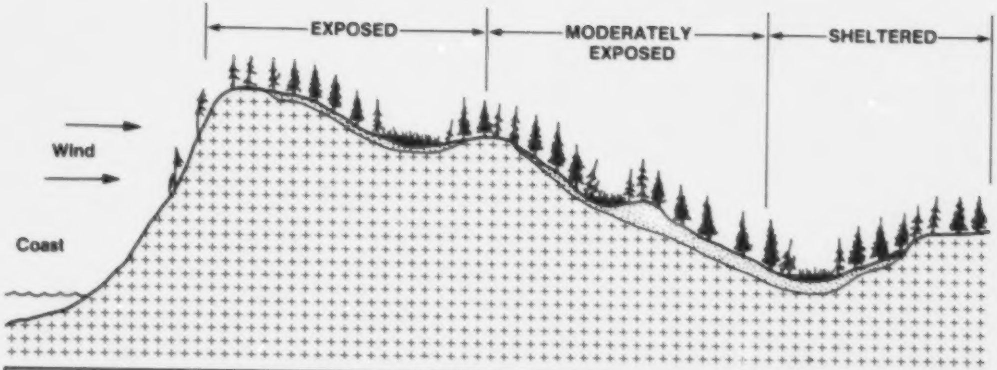
[3] Moisture Regime Scale in Table 21. Page 5-9.

Figure 4. Criteria used to determine the relative frost heave hazard.

layers and periodic flooding increase the hazard of blowdown. Studies on root distribution by Damman (1967, 1971) even on a well drained site in western Newfoundland show that 80-90% of root biomass occurs in the upper 25cm of the mineral soil with no distinct difference between Balsam Fir and Black Spruce. On this basis hazard is not differentiated by species. For the purpose of interpretation, insect infestation and stand age are assumed to be constant between compared sites.

Heavy thinning or plantation spacing in excess of 2.0m is not recommended on sites with a high windthrow hazard.

The relationship between topographic position and soil moisture in defining high (H), moderate (M) and low (L) levels of windthrow hazard in the fact sheets is illustrated in Figure 5.


EXPOSED
MODERATELY EXPOSED
SHELTERED
Wind
Coast

Soil Type[1]	S	M	WD	W	S	M	W	WD	M	W	M	S
Windthrow[2] Hazard	H	H	M	H	H	M	M	L	L	M	L	M

[1] Symbols Used For Soil Types: S=Shallow WD=Well Drained M=Moist W=Wet

[2] Symbols For Windthrow Hazard: L=Low M=Moderate H=High

Figure 5. Criteria used to determine the relative windthrow hazard.

CHAPTER 3

KEYS TO THE FOREST TYPES

The following keys serve to differentiate 35 forest types that are thought to be of significance to forest management in Newfoundland. Fact sheets are provided for 33 merchantable forest types or types that are at least potentially productive using conventional silvicultural prescriptions. The fact sheets summarize general vegetation composition, soil characteristics, terrain relationships and the implication of these features for forest management. Within the keys a few non-merchantable types are identified in order to avoid misidentification and subsequent misapplication of silvicultural treatment. Fact sheets have not been developed for the latter forest types (i.e. Alder Swamps). More in-depth descriptions of any of the forest types described in this manual can be found in the following references:

1) Northern Newfoundland (Damman 1963)
2) Central Newfoundland (Damman 1964)
3) Western Newfoundland (Damman 1967)
4) Eastern Newfoundland (Meades 1986)

The forest types have been grouped under six broad cover types in order to avoid a very complex key including all 35 **forest types (Table 8).**

One should proceed through the general key to cover types very carefully, since a mistake at this level will certainly lead to confusion or misidentification of the forest type. There is considerable variation with respect to the composition and abundance of the tree layer and this may be a source of confusion for foresters used to inventory working group conventions. The limits used for the definition of cover types in this key, i.e. softwoods vs. hardwoods, open forest vs. closed forest, Black Spruce vs. Balsam Fir, etc., represent levels where ecological response (and silvicultural response) to disturbance will be significantly different. For example, stands with greater than 75 percent crown cover of Black Spruce often occur on sites prone to regeneration failures after cutting. Thus, the cover limits used in the key, while being subjective estimates, are not entirely arbitrary. However, it should be emphasized that this broad level of generalization does lead to a certain degree of impracticality. A stand with relatively low cover of a species can still be placed in that cover type. For example, a stand with the composition 25% bF, 50% bS, 15% wS and 10% wB could still fall under a Balsam Fir cover type. The only solution to this problem would be to create a profusion

Table 8. Summary of forest types, abbreviations and fact sheet numbers.

I	**Balsam Fir Forest Types**	
	Equisetum - Rubus - Balsam Fir	(Fre) # 1
	Rubus - Balsam Fir	(Fr) # 2
	Clintonia - Balsam Fir	(Fc) # 3
	Taxus - Balsam Fir	(Ft) # 4
	Dryopteris - Hylocomium - Balsam Fir	(Fdh) # 5
	Dryopteris - Balsam Fir	(Fd) # 6
	Dryopteris - Rhytidiadelphus - Balsam Fir	(Fdr) # 7
	Dryopteris - Lycopodium - Balsam Fir	(Fdl) # 8
	Hylocomium - Balsam Fir	(Fh) # 9
	Gaultheria - Balsam Fir	(Fg) # 10
	Pleurozium - Balsam Fir	(Fp) # 11
II	**Black Spruce Forest Types**	
	Sphagnum - Black Spruce	(Ss) # 12
	Black Spruce - Feathermoss/Bedrock	(SM/R) # 13
	Black Spruce - Feathermoss/Very Dry	(SM/vD) # 14
	Black Spruce - Feathermoss/Dry	(SM/D) # 15
	Black Spruce - Feathermoss/Bog	(SM/B) # 16
	Black Spruce - Feathermoss/Moist	(SM/M) # 17
III	**Black Spruce Fen Types**	
	Carex - Black Spruce	(Sc) # 18
	Osmunda - Black Spruce	(SO)# 19
IV	**Kalmia - Black Spruce Forest Types**	
	Kalmia - Black Spruce	(SK) # 20
	Cladonia - Kalmia - Black Spruce	(SKc) # 21
	Nemopanthus - Kalmia - Black Spruce	(SKn) # 22
	Sphagnum - Kalmia - Black Spruce	(SKs) # 23
V	**Hardwood Forest Types**	
	Birch - Aspen	(BtA) # 24
	Dryopteris - Clintonia - Birch	(Bdc) # 25
	Mountain Alder - Birch	(BmA) # 26
	Rubus - Birch	(Br) # 27
	Dryopteris - Birch	(Bd) # 28
	Kalmia - Birch	(BK) # 29

VI Hardwood Thickets and Heath Types

Galium - Mountain Maple	(Mg) # 30
Carex - Mountain Maple	(Mc) -
Lycopodium - Alder Swamp	(AL) # 31
Alluvial - Alder Swamp	(Aa) -
Birch Thickets	(Bt) # 32
Kalmia Heath	(K) # 33

---

of cover type x site type interactions that would create a classification system that is equally impractical to apply. If further division of the ecological forest type is warranted, the user can apply the forest inventory working designation as a phase of the ecological forest type (i.e., Hylocomium-bF forest type/bF bS wB phase).

The general cover type key (Table 9) relies entirely on major differences in the structure and composition of the forest (i.e., species, height and crown cover). These criteria are applied at the stand level usually in plots 100-200m^2 in area. Within the cover types, sub-division to forest type is accomplished most frequently using a combination of presence or absence of understory plant species, soil moisture regime and soil texture. All plant species used in the keys are illustrated using both line drawings and color photographs (Chapter 7). The number in brackets after each species name refers to the plate number for both drawings and photos. Techniques for assessing soil moisture regime and soil texture are provided in Chapter 5 - Soil Characteristics. Other features such as ecoregion, slope position, landscape type, etc. are given to assist in identification.

In a dichotomous key all of the characteristics used in one side of the dichotomy should be weighed against the alternate since in many situations the choice is often the "lesser of two evils" rather than "black vs white". Using the summary tables (Tables 9-18) the user can double check a diagnosis and see the position of a particular forest type with respect to other closely related types. These tables are also useful for a quick reference to fact sheet numbers and general site characteristics and productivity.

The forest types in this manual represent mature phases with few exceptions and this creates some difficulty for sites that have recently been disturbed by fire or cutting. Forestry Canada is currently undertaking studies to classify seral vegetation because of its importance to site prescription, particularly, decisions on vegetation management. In the interim, fact sheet 32 provides a tentative structural classification of seral vegetation. The recognition of all combinations of seral vegetation types with soil types would result in a totally impractical classification system with more than 100 types. Therefore, it is recommended that the user should try to mentally reconstruct the original stand composition based on stump evidence, use soil characteristics to identify the mature forest type, and then use fact sheet 32 to identify the tentative vegetation phase of the forest type.

Finally, it must be stressed that there are numerous aberrant forest types that will not readily fit this classification. Such sites can represent unique site conditions, unique disturbance patterns or unusual conditions of very high or very low seed production at the time of the most recent disturbance. If these sites are relevant to operations they should be described as distinct. If such sites frequently recur then some attempt should be made to accommodate these site types in future revisions of the classification. However, it should be kept in mind that the utility of any classification system decreases as the number of types increases.

GENERAL KEY TO FOREST TYPES

A1. Forests with at least 60% of the merchantable stems representing softwood trees greater than 5.0m in height.

GO TO B

A2. Forests with more than 50% of the merchantable stems comprised of hardwood trees or sites dominated by hardwood shrubs.

GO TO E

B1. Closed softwood stands with at least 70% crown cover of trees greater than 5.0m in height.

GO TO C

B2. Open softwood forests with up to 70% of the ground vegetation dominated by low shrubs or herbs.

GO TO D

C1. Closed canopy softwood stands with less than 75% crown cover of Black Spruce.

I. Balsam Fir Forest Types

C2. Closed canopy softwood stands with more than 75% crown cover of Black Spruce.

II. Black Spruce Forest Types

D1. Open Black Spruce forest with sedges and forbs dominant; ericaceous shrubs may be abundant but not dominant.

III. Black Spruce Fen Types

D2. Open Black Spruce forests with an understory dominated by ericaceous shrubs and lichens; sedges and forbs sparse or absent.

IV. Kalmia-Black Spruce Forest Types

E1. Hardwood forests with merchantable sized trees covering at least 50% of the site.

V. Thickets and Heath Types

E2. Hardwood thicket vegetation usually less than 3.0m in height with birch, alder, Mountain Maple or ericaceous shrubs dominant.

VI. Hardwood Thicket Types

Table 9. General diagrammatic key to forest and thicket cover types.

<table>
<tr><td colspan="4">SOFTWOOD FORESTS
Softwood Stems ≥3m ≥ 60% Stand Density</td><td colspan="2">HARDWOOD FORESTS AND THICKETS
Hardwood Stems ≥ 50% Stand Density</td></tr>
<tr><td colspan="2">CLOSED SOFTWOOD CROWN COVER
≥ 70%
Ferns, Herbs, Mosses Abundant</td><td colspan="2">OPEN SOFTWOOD CROWN COVER
≤ 70%
Dwarf Shrubs, Lichens or Sedges Abundant</td><td colspan="2"></td></tr>
<tr><td>Crown Cover:
Black Spruce ≤ 75%
Balsam Fir Abundant
Mostly Herb and
Fern Rich Understory</td><td></td><td>Open Conifer Forest
on Wet Sites
Sedges and
Forbs Abundant
Shrubs in Small
Patches</td><td></td><td>Crown Cover:
Hardwood Trees ≥ 50%
≥ 3.0m Height
White Birch
Trembling Aspen
Yellow Birch</td><td></td></tr>
<tr><td></td><td>Crown Cover:
Black Spruce ≥ 75%
Balsam Fir Sparse
Feathermoss and
Sphagnum Understory</td><td></td><td>Open Conifer Forest
on Wet or Dry Sites
<i>Kalmia angustifolia</i> (6)
and Lichens Abundant
Sedges and
Forbs Sparse</td><td></td><td>Thickets or Heath
Dominated by Shrubs
≤ 3.0m Height
Alders (3,4)
Birches
<i>Kalmia angustifolia</i> (6)
or <i>Acer spicatum</i> (2)</td></tr>
<tr><td>I
BALSAM FIR
FOREST TYPES
Table 10 (p.3-13)</td><td>II
BLACK SPRUCE
FOREST TYPES
Table 14 (p.3-20)</td><td>III
BLACK SPRUCE
FEN TYPES
Table 15 (p.3-24)</td><td>IV
KALMIA- BLACK SPRUCE
FOREST TYPES
Table 16 (p.3-28)</td><td>V
HARDWOOD
FOREST TYPES
Table 17 (p.3-32)</td><td>VI
HARDWOOD THICKETS
AND HEATH TYPES
Table 18 (p.3-37)</td></tr>
</table>

BALSAM FIR
FOREST TYPES

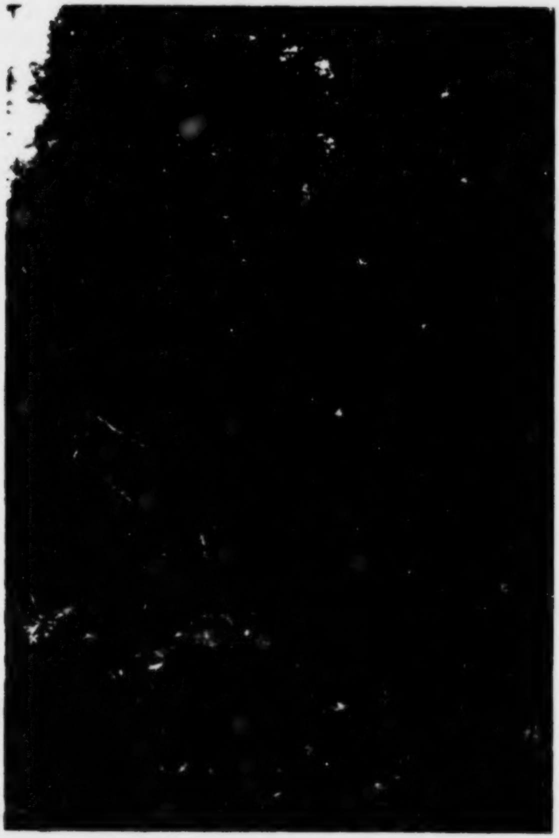


photo: W.J. Meades

Dryopteris-Balsam Fir (#6)

I. BALSAM FIR FOREST TYPES

Balsam Fir is the climax tree species throughout most of insular Newfoundland, replaced naturally by Black Spruce only on extremely wet and dry nutrient-poor sites. The success of Balsam Fir is attributed to its ability to readily establish as advance regeneration and survive in the deep shade of parent trees. For this reason, Balsam Fir regeneration rarely fails after harvest, and overstocking rather than regeneration failure is more often the problem for forest managers. The only notable exception to this generalization is the nutrient-rich Balsam Fir forest types where excessive competition from ferns and herbs in the understory can cause excessive seedling mortality and therefore questionable stocking levels.

After fire, Balsam Fir types are often replaced by Black Spruce-Feathermoss types or hardwoods. Balsam Fir is poorly adapted to withstand fire because its seeds are shed annually in fall and winter prior to the fire season and the cones are resinous and are completely consumed by fire. Also, residual fir that escapes fire can only disperse most of its seed within 3-5 tree heights of the source. As a general rule, moist maritime forests on nutrient-rich sites lack adequate Black Spruce seed source and regenerate to hardwood forest types after fire. The dry sites particularly in the interior of the Island, tend to readily regenerate to Black Spruce-Feathermoss types.

The key recognizes 11 Balsam Fir forest types that occur over a wide range of nutrient and moisture regimes.

1. KEY TO BALSAM FIR FOREST TYPES

A1. Tree layer with Balsam Fir dominant and White Birch abundant; herb or fern rich understory with moss layer poor to well developed; most frequently in sloping terrain and nutrient-rich seepage waters. Seral vegetation arising from fire and cutting, usually dominated by hardwood shrubs and raspberry. Presence of the following species differentiate these forest types from those of group A2:

Acer spicatum (2)
Viburnum edule (21)
Sambucus pubens (16)
Rubus idaeus (15)
Ribes glandulosum (11)
Rhytidiadelphus loreus (81)
Hylocomium umbratum (77)
Streptopus roseus (69)
Solidago macrophylla (66)

GO TO B

A2. Tree layer with Balsam Fir and Black Spruce abundant and occasional White Birch; understory dominated by feather-mosses without pronounced development of herb or fern layers. Most frequently in rolling or undulating relief. Seral vegetation arising from cutting and fire usually characterized by ericaceous shrubs and lichens. The Hylocomium-Balsam Fir type (#9) is an important exception to this generalization. Differential species of A1 absent or very sparse.

GO TO I

B1. Herb dominated forest; mid to lower slope positions; somewhat moist (MR3) to somewhat wet (MR5) gleyed podzols or gleysols of variable texture. Presence of the following species differentiate these forest types from those of group B2:

Rubus pubescens (62)
Galium triflorum (53)
Cinna latifolia (38)
Cornus stolonifera (5)
Rhytidiadelphus triquetrus (83)
Viola incognita (71)
Mitella nuda (59)
Ribes triste (14)
Ribes lacustre (13)
Dryopteris disjuncta (26)

GO TO C

B2. Species in group B1 absent; forest understory dominated by a combination of shrubs and herbs or by ferns; well drained to moist (MR2-4) orthic or gleyed podzol with seepage in the lower B horizon (30+cm).

GO TO D

C1. Moist (MR4) to somewhat wet (MR5) gleyed regosol or orthic gleysol with distinct muck horizon (Om/or/Oh). Presence of the following species differentiate this type **from all other Balsam Fir forest types**:

Carex leptonervia (42)
Dryopteris phegopteris (28)
Equisetum sylvaticum (34)
Thuidium recognitum (84)
Mnium punctatum (78)
Athyrium filix-femina (25)
Circaea alpina (48)
Aster puniceus (46)
Geum rivale (54)
Sphagnum squarrosum (91)
Rhytidiadelphus squarrosus (82)

Equisetum-Rubus-Balsam-Fir (Fre) #1

C2. Somewhat moist (MR3) to moist (MR4) gleyed humic podzol or humic gleysol with distinct LFH horizon. Differentiated from all other Balsam Fir types by the presence of species group B1 and the absence of species group C1.

Rubus-Balsam Fir (Fr) #2

D1. Fern dominated forest, *Dryopteris spinulosa* (29) (30) (31); level to steeply sloping terrain; well drained (MR2) to somewhat moist (MR4)podzols with seepage at 40+cm. Species in group B1 absent.

GO TO F

D2. Forest understory dominated by feathermosses and herbs; ferns in small patches or sparse; orthic and gleyed podzols in somewhat moist (MR3) upper to mid-slope position; at least some of the species in group A1 present; White Birch not abundant.

GO TO E

E1. Moss dominated forest with a well developed herb layer particularly *Clintonia borealis* (49); usually on acidic podzols with slight mottling; in the northern and eastern ecoregions.

Clintonia-Balsam Fir (Fc) #3

E2. Moss dominated forest with a well developed shrub layer dominated by *Taxus canadensis* (17); usually on gleyed podzol on shallow or rocky limestone till in the northern and western ecoregions.

Taxus-Balsam Fir (Ft) #4

F1. Ferns covering 30-50%; feathermoss understory dominated by *Hylocomium splendens* (76) and fern stratum dominated by *Dryopteris spinulosa* var. *americana* (30); well drained to somewhat moist (MR2-3) orthic podzol on sandy loam or loamy sand.

Dryopteris-Hylocomium-Balsam Fir (Fdh) #5

F2. Ferns covering 50-95%; moss layer in small patches or absent; somewhat moist to moist (MR3-4) gleyed podzol with seepage (mottles) at 40+cm.

GO TO G

G1. *Dryopteris spinulosa* var. *americana* (30) 75-95% cover and up to 1.0m height; moss layer sporadic. Nutrient rich orthic podzols in western, northern and eastern ecoregions.

Dryopteris-Balsam Fir Forest (Fd) #6

G2. *Dryopteris spinulosa* var. *americana* (30) 25-75% cover; moss layer in small patches (15-25% cover); somewhat moist (MR3) to moist (MR4) gleyed podzols and gleysols.

GO TO H

H1. Moss layer dominated by *Rhytidiadelphus loreus* (81), *Hylocomium umbratum* (77) and *Dicranum majus* (73); *Vaccinium ovalifolium* (19) common. On limestone till in the Western Newfoundland Ecoregion.

Dryopteris-Rhytidiadelphus-Balsam Fir (Fdr) #7

H2. Moss layer dominated by *Hylocomium splendens* (76) and *Pleurozium schreberi* (79); nutrient rich, loam to silt loam tills in the Central Newfoundland Ecoregion. Presence of the following species differentiate this type from all other Dryopteris-Balsam Fir forest types:

Lycopodium annotinum (35)
Lycopodium lucidulum (36)
Actaea rubra (44)
Viola incognita (71)

Dryopteris-Lycopodium-bF (Fdl) #8

I1. Balsam Fir or Balsam Fir-Black Spruce forest with White Birch sparse or absent; feathermoss understory and poorly developed herb layer; nutrient-poor dry to moist (MR1-4) sites; the following species sparse under full crown closure but becoming abundant after clear-cutting, fire and heavy insect infestation:

Nemopanthus mucronata (8)
Vaccinium angustifolium (18)
Deschampsia flexuosa (39)
Rhododendron canadense (10)
Pteridium aquilinum (33)
Kalmia angustifolia (6)
Viburnum cassinoides (20)
Dicranum polysetum (74)
Ledum groenlandicum (7)

GO TO J

I2. Balsam Fir-White Birch forest with *Hylocomium splendens* (76) dominant in the moss carpet; somewhat moist to moist (MR3-4) gleyed podzols or seepage gleysols; early succession after disturbance dominated by hardwoods and raspberry rather than ericaceous shrubs in group I1, the following herbs may occur sporadically:

Listera cordata (58)
Moneses uniflora (60)
Goodyera repens (55)

Hylocomium-Balsam Fir (Fh) #9

J1. Balsam Fir-Black Spruce forests with White Birch sparse or absent; somewhat moist to moist (MR3-4) sites with a thick (10+cm) raw humus layer; flat to gently sloping terrain in the Western Newfoundland Ecoregion. Presence of the following species sometimes in combination with group I2 species differentiate this type from J2:

Epigaea repens (23)
Osmunda cinnamomea (32)
Coptis groenlandica (50)
Taxus canadensis (17)

Gaultheria-Balsam Fir (Fg) #10

J2. Balsam Fir-Black Spruce forests with *Pleurozium schreberi* (79) dominant in the moss carpet; dry to well drained (MR1-2) upland sites with orthic podzols; dry ridges and outwash deposits. Differential species of groups I2 and J1 absent.

Pleurozium-Balsam Fir (Fp) #11

Table 10. Diagrammatic key to subdivisions of the Balsam Fir forests (modified from Damman 1967).

<table>
<tr><td colspan="3">TREE LAYER</td></tr>
<tr><td colspan="2">Balsam Fir-White Birch-Fern and Herb Rich Forests
White Spruce and Hardwoods Co-Dominant</td><td>Balsam Fir-Black Spruce -Feathermoss Forests
Hardwoods Infrequent</td></tr>
<tr><td colspan="3">UNDERGROWTH</td></tr>
<tr><td>Herbs Dominant
Ferns in Patches, Usually < 25% Cover
Mosses in Small Patches 10-15% Cover
Moist to Wet Lower Slopes</td><td><i>Dryopteris spinulosa</i> (29, 30, 31) 25-90% Cover
Herbs Present but Not Dominant
Mosses 10-80% Cover
Moist Mid Slopes</td><td>Ferns and Herbs in Very Small Patches ≤ 15% Cover
Feathermosses > 80% Cover
Dwarf Shrubs Scattered
Upper-Mid Slopes : Dry-Moist</td></tr>
<tr><td colspan="3">DIFFERENTIAL SPECIES</td></tr>
<tr><td colspan="2"><i>Acer spicatum</i> (2)
<i>Rubus ideaus</i> (15)
<i>Vaccinium ovalifolium</i> (19)
<i>Hylocomium umbratum</i> (77)

<i>Streptopus roseus</i> (68)
<i>Viburnum edule</i> (21)
<i>Sambucus pubens</i> (16)
<i>Dryopteris spinulosa</i> (29)

<i>Streptopus amplexifolius</i> (69)
<i>Rhytidiadelphus loreus</i> (81)
<i>Solidago macrophylla</i> (66)
<i>Ribes glandulosum</i> (11)</td><td><i>Kalmia angustifolia</i> (6)
<i>Nemopanthus mucronata</i> (8)
<i>Viburnum cassinoides</i> (20)
<i>Ledum groenlandicum</i> (7)</td></tr>
<tr><td><i>Rubus pubescens</i> (62)
<i>Taxus canadensis</i> (17)
<i>Aster puniceus</i> (46)
<i>Ribes lacustre</i> (13)
<i>Circaea alpina</i> (48)
<i>Dryopteris phegopteris</i> (28)

<i>Cinna latifolia</i> (38)
<i>Cornus stolonifera</i> (5)
<i>Galium triflorum</i> (53)
<i>Mitella nuda</i> (59)
<i>Dryopteris disjuncta</i> (26)
<i>Geum rivale</i> (54)

<i>Rhytidiadelphus triquetrus</i> (83) Abundant
<i>Clintonia borealis</i> (49) Abundant</td><td></td><td></td></tr>
<tr><td>IA
Balsam Fir-Herb Rich Forests
Table 11</td><td>IB
Balsam Fir-Fern Rich Forests
Table 12</td><td>IC
Balsam Fir-Black Spruce - Moss Rich Forests
Table 13</td></tr>
</table>

Table 11. Diagrammatic key to the Balsam Fir-Herb Rich forest types (modified from Damman 1967).

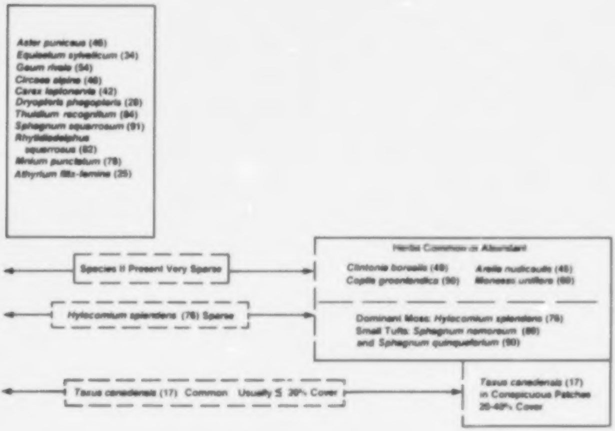
STAND STRUCTURE

BALSAM FIR - HERB RICH FORESTS

DIFFERENTIAL SPECIES

Rubus pubescens (82)
Cinna latifolia (38)
Cornus stolonifera (5)
Ribes triste (14)
Dryopteris disjuncta (26)
Rhytidiadelphus triquetrus (83) Abundant

Galium triflorum (53)
Viola incognita (71)
Ribes lacustre (13)
Mitella nuda (90)



Aster puniceus (46)
Equisetum sylvaticum (34)
Geum rivale (54)
Circaea alpina (46)
Carex leptonervia (42)
Dryopteris phegopteris (28)
Thuidium recognitum (84)
Sphagnum squarrosum (91)
Rhytidiadelphus squarrosus (82)
Mnium punctatum (78)
Athyrium filix-femina (25)

Species If Present Very Sparse

Hylocomium splendens (76) Sparse

Taxus canadensis (17) Common Usually ≤ 20% Cover

Herbs Common or Abundant
Clintonia borealis (48) *Aralia nudicaulis* (45)
Coptis groenlandica (50) *Moneses uniflora* (60)

Dominant Moss: *Hylocomium splendens* (76)
Small Tufts: *Sphagnum nemoreum* (88)
and *Sphagnum quinquefarium* (90)

Taxus canadensis (17)
in Conspicuous Patches
20-40% Cover

SOIL TYPE AND MOISTURE REGIME (MR)

Humic Gleysol-Organic Muck	Gleyed Podzol-Orthic Gleysol	Orthic Ferro-Humic Podzol Gleyed Ferro-Humic Podzol	Gleyed Podzol or Gleysol Rocky Limestone Till
MR 4-5	MR 3-4	MR 2^+-3	MR 3

FOREST CLI CLASS AND SUBCLASS

4w	3'w-3w	4w-4rw	4s-5s

FOREST TYPE: SYMBOL AND FACT SHEET #

Equisetum-Rubus Balsam Fir	Rubus-Balsam Fir	Clintonia-Balsam Fir	Taxus-Balsam Fir
Fre (#1)	Fr (#2)	Fc (# 3)	Ft (# 4)

Table 12. Diagrammatic key to the Balsam Fir-Fern Rich forest types (modified from Damman 1967).

STAND STRUCTURE

BALSAM FIR - FERN RICH FORESTS *Dryopteris spinulosa var. americana* (38) Abundant

DIFFERENTIAL SPECIES

Open Fern Layer 30-50% Cover	Ferns Dominant 75-90% Cover	Ferns in Large Patches 25-75% Cover	
Moss Carpets 30-50% Cover	Mosses Sparse	Mosses in Small Patches 15-20% Cover	
Dominant Mosses: *Hylocomium splendens* (76) *Pleurozium schreberi* (79)			
		Dominant Mosses: *Rhytidiadelphus loreus* (81) *Dicranum majus* (73) *Hylocomium umbratum* (77) Common Shrub: *Vaccinium ovalifolium* (19)	
			Lycopodium annotinum (35) *Lycopodium lucidulum* (38) *Viola incognita* (71) *Actaea rubra* (46)

SOIL TYPE AND MOISTURE REGIME (MR)

Orthic Ferro-Humic Podzol on Sandy Loam or Loamy Sand; ↑ Seepage ≥ 30cm	Orthic or Fragic Humic Podzol on Loams and Silt Loams; Slight Seepage	Gleyed Ferro-Humic Podzol on Calcareous Basal Till Loam or Silt Loam	Fragic Humic Podzol or Humic Gleysol; Seepage in C horizon
MR 2-3	MR 2+ -3	MR 3-4	3-4

FOREST CLI CLASS AND SUBCLASS

3w-4w	2C-3s	3s-4s	2C-3w

FOREST TYPE, SYMBOL AND FACT SHEET #

Dryopteris-Hylocomium-Balsam Fir	Dryopteris-Balsam Fir	Dryopteris-Rhytidiadelphus-Balsam Fir	Dryopteris-Lycopodium-Balsam Fir
Fdh (#5)	Fd (#6)	Fdr (#7)	Fdl (#8)

Table 13. Diagrammatic key to the Balsam Fir-Black Spruce-Moss Rich forest types (modified from Damman 1967).

STAND STRUCTURE

Balsam Fir-Black Spruce Dominant White Birch Scattered Shrubs and Herbs Sparse	Balsam Fir-Black Spruce Dominant Shrubs and Herbs Scattered	Balsam Fir-Black Spruce Dominant Dwarf Shrubs Scattered Herbs Very Sparse

DIFFERENTIAL SPECIES

<table>
<tr><td colspan="2">Moss Layer Dominated by <i>Hylocomium splendens</i> (76)
<i>Sphagnum nemoreum</i> (89) and <i>Sphagnum quinquefarium</i> (90) in Patches</td><td><i>Pleurozium schreberi</i> (79)
Dominant</td></tr>
<tr><td colspan="2">Sporadic to Common:
<i>Listera cordata</i> (58) <i>Moneses uniflora</i> (60) <i>Goodyera repens</i> (55)</td><td></td></tr>
<tr><td></td><td colspan="2">Low Cover but Conspicuous Patches:
<i>Kalmia angustifolia</i> (6)
<i>Nemopanthus mucronata</i> (8)
<i>Ledum groenlandicum</i> (7)
<i>Dicranum polysetum</i> (74)
<i>Rhododendron canadense</i> (10)
<i>Viburnum cassinoides</i> (20)
<i>Pteridium aquilinum</i> (33)
<i>Deschampsia flexuosa</i> (39)</td></tr>
<tr><td></td><td>Common in Low Abundance:
<i>Taxus canadensis</i> (17)
<i>Coptis groenlandica</i> (50)
<i>Epigaea repens</i> (23)
<i>Osmunda cinnamomea</i> (32)</td><td></td></tr>
</table>

SOIL TYPE AND MOISTURE REGIME (MR)

Gleyed Ferro-Humic Podzol Seepage over Fragipan or Bedrock	Orthic or Placic Humic Podzol on Loamy Sand Till Transitional to Bog Soils	Orthic and Placic Ferro-Humic Podzol on Sandy Loam or Loamy Sand Till
MR 3-4	MR 3-4	MR 1-2

FOREST CLI CLASS AND SUBCLASS

4F-5MF	5F	5MF

FOREST TYPE: SYMBOL AND FACT SHEET #

Hylocomium- Balsam Fir	Gaultheria- Balsam Fir	Pleurozium- Balsam Fir
Fh (#9)	Fg (#10)	Fp (#11)

BLACK SPRUCE FOREST TYPES

photo: W.J. Meades

Black Spruce-Feathermoss/Dry (#15)

II. KEY TO BLACK SPRUCE FOREST TYPES

The deep raw humus layer so characteristic of the mature Black Spruce-Feathermoss forests in this region considerably moderates the moisture and nutrient status of the underlying mineral soils. Although these forests represent a single vegetation type, differences in growth and successional trends warrant their subdivision into five forest types based on soil characteristics (Damman 1964). In this key vegetation is used solely to separate the feathermoss forest types from the Sphagnum-Black Spruce type.

A1. Black Spruce forest with the understory dominated by Sphagnum mosses and sedge. Some or all of the following species present:

Sphagnum girgensohnii (85)
Sphagnum magellanicum (87)
Rubus chamaemorus (61)
Sphagnum russowii (86)
Smilacina trifolia (65)
Carex trisperma (43)

Sphagnum-Black Spruce (Ss) #12

A2. Black Spruce forest with species group A1 generally lacking or in very low abundance. The forest floor dominated by the following mosses:

Pleurozium schreberi (79)
Ptilium crista-castrensis (80)
Hylocomium splendens (76)

GO TO B

B1. Black Spruce-Feathermoss forest on extremely dry (MR0) to well-drained (MR2) sites underlain by orthic podzols or regosols lacking pronounced mottling. Upland sites often characterized by shallow and/or coarse textured till.

GO TO C

B2. Black Spruce-Feathermoss forest on somewhat moist (MR3) to somewhat wet (MR5) sites underlain by gleyed podzols or gleysols with prominent mottles and/or gleying within 30-40cm of the surface. Usually lowland sites or rolling terrains with surface seepage waters.

GO TO E

C1. Sites with a thick (15-30cm) raw humus horizon over bedrock with or without a shallow layer of till lacking significant profile development.

Black Spruce-Feathermoss/Bedrock (SM/R) #13

C2. Sites with a normal (10-15cm) mor horizon over deep (≥ 1.0m) till usually with a well developed podzolic horizon.

GO TO D

D1. Very dry (MR0) to dry (MR1) sites usually associated with coarse textured glacio-fluvial and river outwash deposits. This forest type is frequently associated with the open Cladonia-Kalmia-Black Spruce forest type of which it represents a closed undisturbed phase.

Black Spruce-Feathermoss/Very Dry (SM/vD) #14

D2. Dry (MR1) to well drained (MR2) sites on sandy loam or loamy sand till usually associated with slope summits. Openings in this forest type would not be dominated by *Cladonia* lichen.

Black Spruce-Feathermoss/Dry (SM/D) #15

E1. Marginally productive sites on flat to rolling terrain, usually associated with bog borders or forest islands in large bogs. Soils are a gleyed humic podzol with distinct greyish Ae horizon over a dark reddish brown Bh horizon. The C horizon displays distinct mottling due to fluctuating ground water.

Black Spruce-Feathermoss/Bog (SM/B) #16

E2. Productive Black Spruce forest on sloping terrain. Soils are gleyed podzols (with Ae) or gleysols with Bg horizon reaching the surface. Surface seepage is usually promoted by a platy fragipan in the C horizon.

Black Spruce-Feathermoss/Moist (SM/M) #17

Table 14. Diagrammatic key to the Black Spruce forest types.

STAND STRUCTURE

Scrubby Black Spruce Bog Forests	Layered Black Spruce Forests on Bedrock Outcrops	Fully Stocked Black Spruce Forests on Well Drained Uplands		Fully Stocked Black Spruce Forests on Wet Lowlands	Very Productive Black Spruce Forests on Seepage Slopes

DIFFERENTIAL SPECIES

Sphagnum Dominant *Sphagnum girgensohnii* (85) *Sphagnum russowii* (86) *Sphagnum magellanicum* (87) *Smilacina trifolia* (65) *Rubus chamaemorus* (51) *Carex trisperma* (43)	
	Feathermosses Dominant *Pleurozium schreberi* (79) *Hylocomium splendens* (76) *Ptilium crista-castrensis* (80)

SOIL TYPE AND MOISTURE REGIME (MR)

Deep Peat with Muck at Surface (Mesic Fibrisol) or Peat Veneer over Rego Gleysol or Gleyed Regosol: Perched Water Table (Always Wet)	Deep Raw Humus Layer (LFH) over Bedrock, sometimes with a Shallow Till Layer: Typic Folisol or Lithic Orthic Regosol.	Orthic Ferro-Humic and Orthic Humo-Ferric Podzols on Coarse Textured Glacio-Fluvial Deposits and Outwash Sands and Gravels.	Orthic and Placic Humo-Ferric Podzols on Sandy Loam or Loamy Sand. Normal Unsorted Glacial Deposits or Rarely Kame and Esker Deposits	Hydromorphic Humus Podzol (Orthic Humic Podzol): Lowlands in Transition to Peat Bogs with High Water Table. (see also Fg (#10))	Orthic and Rego Gleysols or Gleyed Podzols usually on Moist Slopes with Seepage over a Fragipan at 30-40 cm depth.
MR 5-6	MR [illegible]-1	MR 0-1	MR 1-2	MR 4-5	MR 3-4

FOREST CLI CLASS AND SUBCLASS

7FW	6R-7R	6M	5MF	5WF	4F

FOREST TYPE: SYMBOL AND FACT SHEET #

Sphagnum-Black Spruce	bS-Feathermoss on Bedrock	bS-Feathermoss Very Dry	bS-Feathermoss Dry	bS-Feathermoss Bog	bS-Feathermoss Moist
Ss (#12)	SM/R (#13)	SM/vD (#14)	SM/D (#15)	SM/B (#16)	SM/M (#17)

BLACK SPRUCE FEN TYPES

photo: W.J. Meades

Carex-Black Spruce (#18)

III. BLACK SPRUCE FEN TYPES

The forested fens are open Black Spruce forests with a lush understory of sedges, forbs and ferns. The indicator plants in this habitat suggest a high level of fertility; however, poor drainage stunts tree growth and promotes the development of unmerchantable stands. It is the nature of the Newfoundland landscape that these forest types are invariably associated with commercial timber operations, occurring as small, discontinuous openings scattered throughout most watersheds. Logging in the forested fen site types should be avoided for the following reasons:

1) poor drainage requires greater construction and maintenance costs for road and skid trails,

2) **deep organic soils curtail the movement of skidders resulting in down time, unnecessary wear and higher associated logging costs relative to the marginal quality of timber being extracted.**

3) these forest types represent some of the most important habitats with a high diversity of plant and animal life. Where reasonably possible, these environmentally sensitive habitats should be left undisturbed.

The forested fen forest types are distinguished from more nutrient poor organic site types (i.e., Ss, SKs, SKn) by the following species:

Sanguisorba canadensis (63)
Rhamnus alnifolia (9)
Aster puniceus (46)
Rubus pubescens (62)
Thuidium recognitum (84)
Hylocomium umbratum (77)
Rhytidiadelphus triquetrus (83)
Geum rivale (54)
Habenaria dilatata (56)
Equisetum sylvaticum (34)
Viola incognita (71)
Aralia nudicaulis (45)
Listera convallarioides (57)
Mitella nuda (59)

A1. Open Black Spruce-Larch forest with stunted trees and an herbaceous understory with the following species present:

Caltha palustris (47)
Carex flava (41)
Senecio aureus (64)
Viola cucullata (70)
Cypripedium reginae (51)
Campylium polygamum (72)
Mnium punctatum (78)

Carex-Black Spruce (Sc) #18

A2. Open Black Spruce-Fir forest with stunted trees and the following species present:

Osmunda cinnamomea (32)
Solidago macrophylla (66)
Cornus stolonifera (5)
Acer spicatum (2)
Carex leptonervia (42)
Carex trisperma (43)
Dryopteris disjuncta (26)
Viburnum edule (21)
Galium triflorum (53)
Streptopus roseus (69)

Osmunda-Black Spruce (SO) #19

Table 15. Diagrammatic key to the Black Spruce fen types.

Open Fen Meadows with Scattered bS and tL	Scrubby bS Forest with Sedges and Herbs	Scrubby bS Bog Forest with Dwarf Shrubs

DIFFERENTIAL SPECIES

Open Fen Meadows with Scattered bS and tL	Scrubby bS Forest with Sedges and Herbs	Scrubby bS Bog Forest with Dwarf Shrubs
Sanguisorba canadensis (63) *Habenaria dilatata* (56) *Listera convallarioides* (57) *Geum rivale* (54) *Aster puniceus* (46) *Mitella nuda* (59) *Rhamnus alnifolia* (9) *Rubus pubescens* (62) *Aralia nudicaulis* (45)		
Caltha palustris (47) *Carex flava* (41) *Senecio aureus* (64) *Viola cucullata* (70) *Cypripedium reginae* (51) *Campylium polygamum* (72) *Mnium punctatum* (78)		
	Osmunda cinnamomea (32) *Solidago macrophylla* (66) *Lycopodium annotinum* (35) *Viburnum edule* (21) *Cornus stolonifera* (5) *Acer spicatum* (2)	
		Kalmia angustifolia (6) *Rhododendron canadense* (10) *Hylocomium splendens* (76) *Pleurozium schreberi* (79)

SOIL TYPE AND MOISTURE REGIME (MR)

Deep Muck 50-100 cm Terric Fibric Mesisol or Peaty Gleysol	Shallow Muck 30-60 cm Terric Fibrisol or Peaty Gleysol	Usually Fibric Peat on Humic Podzol or Gleysol
MR $\bar{6}$	MR $\bar{5}$	MR 4-$\bar{5}$

FOREST CLI CLASS AND SUBCLASS

7w	7wF	6-7FW

FOREST TYPE: SYMBOL AND FACT SHEET#

Carex- Black Spruce	Osmunda- Black Spruce	Bog Forest Types (See Table 16, p 3-28)
Sc (#18)	SO (#19)	SKn (#22) SKs (#23)

KALMIA-BLACK SPRUCE FOREST TYPES

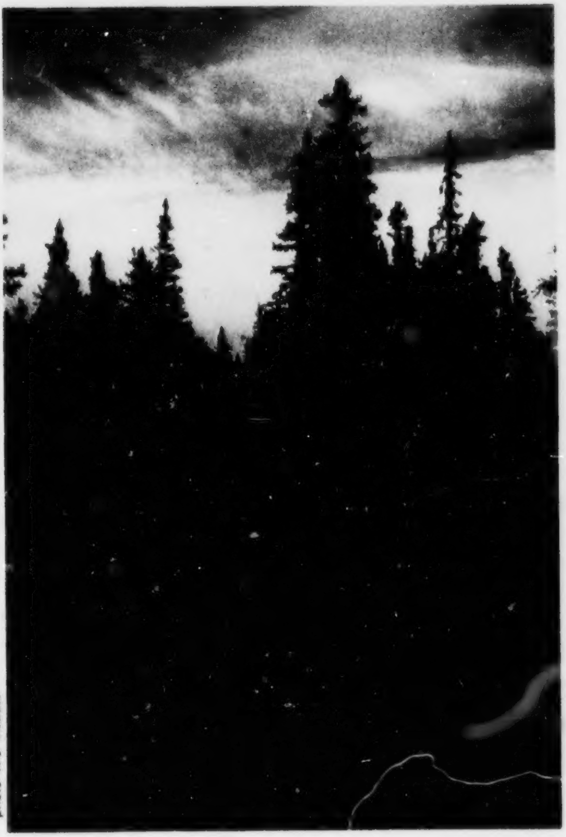


photo W.J Meades

Kalmia-Black Spruce (#20)

IV. KALMIA-BLACK SPRUCE FOREST TYPES

The Kalmia-Black Spruce forest types represent sites with nutrient poor soils over a wide range of moisture conditions. Although the open structure of these stands suggest very similar origin, the three types are successionally distinct. Only the typical Kalmia-Black Spruce forests are derived from Black Spruce-Feathermoss type following poor regeneration after logging or fire. The Cladonia-Kalmia-Black Spruce and Sphagnum-Kalmia-Black Spruce types represent sites which due to moisture and/or nutrient limitations form naturally open stands. These forests are differentiated from all other Black Spruce forest types by their open structure and greater abundance of the following species:

Cladonia mitis (94)
Cladonia rangiferina (95)
Kalmia angustifolia (6)
Rhododendron canadense (10)
Vaccinium angustifolium (18)
Ledum groenlandicum (7)

A1. Open, usually stunted, Black Spruce forest on moist or somewhat wet (MR4-5) sites surrounding bogs; *Sphagnum nemoreum* (89) abundant on the forest floor. Soils are peaty phases of gleyed podzols or gleysols.

GO TO B

A2. Open Black Spruce forest on very dry to well drained sites (MR0-2) usually on uplands; *Sphagnum nemoreum* (89) absent or very infrequent. Soils are usually orthic podzols.

GO TO C

B1. Scrubby Black Spruce forests in eastern and western eco-regions dominated by numerous Black Spruce layers and a tall shrub layer dominated by:

Nemopanthus mucronata (8)
Viburnum cassinoides (20)
Coptis groenlandica (50)
Taxus canadensis (17)

Nemopanthus-Kalmia-Black Spruce (SKn) #22

B2. Scrubby Black Spruce forests in central and northern eco-regions where *Nemopanthus mucronata* (8) and *Viburnum cassinoides* (20) are not present or poorly developed.

Sphagnum-Kalmia-Black Spruce (SKs) #23

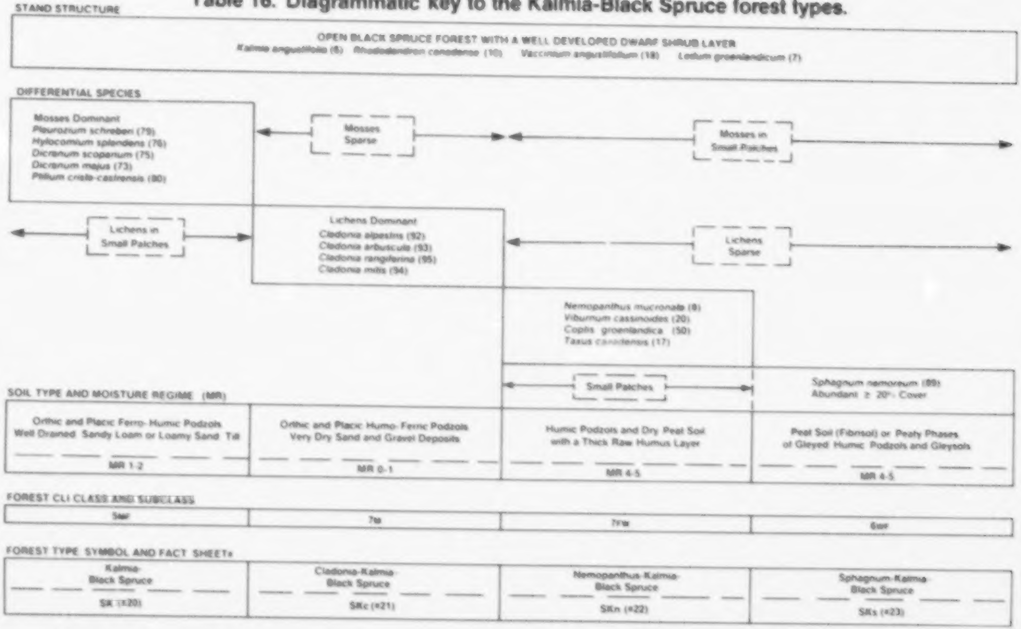
C1. Open Black Spruce stands with some Balsam Fir; *Kalmia angustifolia* (6) covering more than 50% of the forest floor with *Cladonia* lichens in small patches (≤ 30%). Soils are usually orthic podzols on dry to well drained (MR1-2) sandy loam or loamy till.

Kalmia-Black Spruce (SK) #20

C2. Open Black Spruce stands without Balsam Fir; *Kalmia angustifolia* (6) usually covering 25-50% of the forest floor with *Cladonia* lichens, especially *Cladonia alpestris* (92) covering 40-60%. Soils are usually humo-ferric podzols, frequently with ortstein development, on very dry to dry (MR0-1) coarse textured sands and gravels (rarely on shallow till over bedrock).

Cladonia-Kalmia-Black Spruce (SKc) #21

Table 16. Diagrammatic key to the Kalmia-Black Spruce forest types.


STAND STRUCTURE
OPEN BLACK SPRUCE FOREST WITH A WELL DEVELOPED DWARF SHRUB LAYER
Kalmia angustifolia (6) Rhododendron canadense (10) Vaccinium angustifolium (18) Ledum groenlandicum (7)
DIFFERENTIAL SPECIES
Mosses Dominant
Pleurozium schreberi (79)
Hylocomium splendens (76)
Dicranum scoparium (75)
Dicranum majus (73)
Ptilium crista-castrensis (80)
Mosses Sparse
Mosses in Small Patches
Lichens in Small Patches
Lichens Dominant
Cladonia alpestris (92)
Cladonia arbuscula (93)
Cladonia rangiferina (95)
Cladonia mitis (94)
Lichens Sparse
Nemopanthus mucronata (8)
Viburnum cassinoides (20)
Coptis groenlandica (50)
Taxus canadensis (17)
Small Patches
Sphagnum nemoreum (89)
Abundant ≥ 20% Cover
SOIL TYPE AND MOISTURE REGIME (MR)
Orthic and Placic Ferro-Humic Podzols
Well Drained Sandy Loam or Loamy Sand Till
MR 1-2
Orthic and Placic Humo-Ferric Podzols
Very Dry Sand and Gravel Deposits
MR 0-1
Humic Podzols and Dry Peat Soil
with a Thick Raw Humus Layer
MR 4-5
Peat Soil (Fibrisol) or Peaty Phases
of Gleyed Humic Podzols and Gleysols
MR 4-5
FOREST CLI CLASS AND SUBCLASS
5wF
7m
7Fw
6wF
FOREST TYPE SYMBOL AND FACT SHEET#
Kalmia-Black Spruce
SK (#20)
Cladonia-Kalmia-Black Spruce
SKc (#21)
Nemopanthus-Kalmia-Black Spruce
SKn (#22)
Sphagnum-Kalmia-Black Spruce
SKs (#23)

HARDWOOD FOREST TYPES

photo: W.J. Meades

Dryopteris-Birch (#28)

V. HARDWOOD FOREST TYPES

With the exception of very unstable substrates such as talus slopes and river floodplains, hardwoods do not form a stable forest type in Newfoundland. However, White Birch, Yellow Birch and Aspen because of their light seed and sprouting habit can readily take over areas where softwood regeneration has failed, provided the sites are medium to rich in nutrient status. On poorer sites ericaceous shrubs such as *Kalmia angustifolia* (6) and *Rhododendron canadense* (10) appear to be the superior competitors. Although from a theoretical viewpoint the hardwood cover types are not stable, the softwood seed-in process can take in excess of one or two rotations depending on the size of the area and distribution of the softwood seed source.

Hardwood stands dominated by White Birch can be found throughout Newfoundland, however, Yellow Birch is generally absent from central and northern Newfoundland (Damman 1983). Trembling Aspen occurs in the western, central and North Shore Ecoregions; however, it only forms extensive stands in central Newfoundland (Page, 1972). Only one Aspen type has been identified to date within central Newfoundland. Most of the White Birch forest types described probably have equivalent Aspen phases, however the splitting of forest types on the basis of cover types is not necessary for site classification.

A1. Sites with more than 50% crown cover of Trembling Aspen; usually somewhat moist to moist (MR3-4) gleyed podzols in the Central Newfoundland Ecoregion.

Birch-Aspen (BtA) #24

A2. Sites with birch dominant in the tree layer; on a wide variety of soil moisture regimes and textures.

GO TO B

B1. White Birch forests on somewhat moist to somewhat wet (MR3-5) gleyed podzols and gleysols with the following species group present:

Acer spicatum (2)
Viola incognita (71)
Clintonia borealis (49)
Solidago macrophylla (66)
Streptopus roseus (69)
Dryopteris spinulosa var. *intermedia* (31)

GO TO C

B2. White Birch forests on well drained to somewhat moist (MR2-3) sites; soils usually orthic podzols with seepage in the C horizon. Differential species of B1 absent.

GO TO E

C1. Birch forests with an understory dominated by herbs. The following differential species present:

Rubus pubescens (62)
Mitella nuda (59)
Cinna latifolia (38)
Viburnum cassinoides (20)
Nemopanthus mucronata (8)
Solidago rugosa (67)
Galium triflorum (53)
Dryopteris disjuncta (26)
Coptis groenlandica (50)
Acer rubrum (1)

GO TO D

C2. Birch forests with an understory dominated by ferns; *Dryopteris spinulosa* var. *americana* (30) dominant. Differential species in group C1 sparse.

Dryopteris-Clintonia-Birch (Bdc) #25

D1. Birch forests on talus and scree slopes with mineral soil and exposed rocks on the forest floor; *Alnus crispa* (3) prominent in canopy openings.

Mountain Alder-Birch (BmA) #26

D2. Birch forests on stable slopes with seepage near the surface; herbs dominant in the forest floor.

Rubus-Birch (Br) #27

E1. Birch forest on well drained to somewhat moist (MR 2-3) orthic podzols on loam or silt loam with *Dryopteris spinulosa* var. *americana* (30) covering 75-100% of the forest floor.

Dryopteris-Birch (Bd) #28

E2. Birch forest on well drained (MR2) orthic podzols on sandy loam or loamy sand with *Kalmia angustifolia* (6) covering 30-50% of the forest floor; ferns are sparse to absent.

Kalmia-Birch (BK) #29

Table 17. Diagrammatic key to the Hardwood forest types (modified from Damman 1967).

STAND STRUCTURE	Aspen-Birch Forest Herb Rich wB tA rM	White Birch Forest Fern and Herb Rich wB yB	Open Birch Forest Alder Abundant wB	White Birch Forest Herb Rich wB rM yB	White Birch Forest Fern Dominant wB yB	White Birch Forest Dwarf Shrubs wB wS bS
DIFFERENTIAL SPECIES	*Populus tremuloides* ≥ 50% Cover					
	Acer spicatum (2) *Viola incognita* (71) *Clintonia borealis* (49) *Solidago macrophylla* (66) *Streptopus roseus* (35) *Dryopteris spinulosa* var. *intermedia* (31)					
	COMMON	SPARSE	*Rubus pubescens* (62) *Mitella nuda* (59) *Cinna latifolia* (38) *Viburnum cassinoides* (20) *Nemopanthus mucronata* (8) *Solidago rugosa* (67) *Galium triflorum* (53) *Dryopteris disjuncta* (26) *Coptis groenlandica* (50) *Acer rubrum* (1)			
		Dryopteris spinulosa (30)			*Sambucus pubens* (16) *Dryopteris spinulosa* var *americana* (30) Dominant	
			Alnus crispa (3)			*Kalmia angustifolia* (6) *Ledum groenlandicum* (7) *Vaccinium angustifolium* (18) *Alnus crispa* (3)
SOIL TYPE AND MOISTURE REGIME (MR)	Orthic Humic Podzol or Gleyed Ferro-Humic Podzol MR 3-4	Orthic or Gleyed Podzols With Seepage MR 2^+-4	Orthic Regosols Scree and Talus MR 3-4	Gleyed Ferro-Humic Podzol Rocky Colluvium MR 4-5	Orthic Podzol on Loam or Silty Loam MR2^+-3^+	Orthic Podzol or Orthic Humic Podzol on Sandy Loam MR 2^+
FOREST CLI CLASS AND SUBCLASS	3M-4W	3M-4M	7R	4W	2C-3M	5MP
FOREST TYPE: SYMBOL AND FACT SHEET #	Birch - Aspen BtA (#24)	Dryopteris- Clintonia- Birch Bdc (#25)	Mountain Alder- Birch BmA (#26)	Rubus - Birch Br (#27)	Dryopteris- Birch Bd (#28)	Kalmia- Birch Bk (#29)

HARDWOOD THICKET AND HEATH TYPES

photo: Doyle Wells

Lycopodium-Alder Swamp (#31)

VI. HARDWOOD THICKETS AND HEATH TYPES

The Hardwood Thickets described in this section represent vegetation development of varying stability. The Galium-Mountain Maple Thickets and Lycopodium-Alder Swamps occur on sites that were previously dominated by conifer forest in the last rotation but failed to regenerate following cutting and/or fire. Succession back to softwood dominance, if possible, will require time equivalent to several rotations. From a silvicultural perspective this is unfortunate since these sites can yield in the range of 150-180m^3/ha (Damman 1964), possibly even more with good management. The Kalmia Heaths have a similar successional status but occur on much less productive sites (60-150m^3/ha). However, the extent of these site types particularly in eastern and central Newfoundland makes management of this vegetation type of importance to forestry. It is clearly a case where an ounce of prevention is worth a pound of cure.

The Birch Thicket types represent a seral vegetation phase following cutting and fire on medium to nutrient rich sites. Where stocked, this vegetation will be replaced by coniferous forest. However, understocked sites will probably develop into semipermanent birch or Aspen stands. The composition and productivity of this seral vegetation is currently under study by Forestry Canada and only a tentative classification is proposed at this stage.

A1. Hardwood Thickets dominated by Mountain Maple, *Acer spicatum* (2), on moist to wet (MR4-6) seepage slopes.

GO TO B

A2. Hardwood Thickets not dominated by Mountain Maple.

GO TO C

B1. Dense Mountain Maple Thickets with a few large softwood trees and White or Yellow Birch; moist to somewhat wet (MR4-5) seepage slopes primarily in the Western Newfoundland Ecoregion. The presence of the following species differentiate this type from that of B2:

Galium kamtschaticum (52)
Sambucus pubens (16)
Mitella nuda (59)

Galium-Mountain Maple (Mg) #30

B2. Open Mountain Maple Thickets with softwoods absent or stunted; usually wet (MR6) soils with seepage waters near the surface. The following species are present:

Sanguisorba canadensis (63)
Equisetum sylvaticum (34)
Senecio aureus (64)
Geum rivale (54)
Aster puniceus (46)
Solidago rugosa (67)

Carex-Mountain Maple (Mc)

No fact sheet is provided for this vegetation type because it is non-productive forest.

C1. Hardwood Thickets dominated by Speckled Alder, *Alnus rugosa* (4), with sporadic softwood trees.

GO TO D

C2. Hardwood Thickets not dominated by Speckled Alder.

GO TO E

D1. Dense Alder Thickets with scattered Balsam Fir and/or White Spruce showing good growth; somewhat wet (MR4-5) sites on seepage slopes; understory dominated by hardwood litter and sporadic patches of sedges and forbs. Presence of the following species differentiate this type from those of D2:

Lycopodium annotinum (35)
Lycopodium lucidulum (36)

Lycopodium-Alder Swamp (AL) #31

D2. Dense Alder Thickets with individual softwood trees showing poor growth. Moist to somewhat wet (MR4-5) periodically inundated sites frequently associated with floodplains; the understory vegetation is dominated by sedges and forbs. Presence of the following species differentiate this type from that of D1.

Circaea alpina (48)
Habenaria dilatata (56)
Geum rivale (54)
Equisetum sylvaticum (34)

Alder Swamps (Aa)

Damman (1964, 1967) recognized seven vegetation types in this grouping. These types are unmerchantable and unsuitable for silvicultural treatment. No fact sheets are provided because these are non-productive forest lands.

E1. **Birch 1-3m in height, dominant usually on medium to rich, somewhat moist to moist (MR3-4) sites.**

Birch Thickets (Bt) #32

E2. Dwarf Shrub Heath vegetation, usually less than 1.0m in height, dominant; on dry to well drained (MR1-2) nutrient poor sites. The following species are dominant:

Kalmia angustifolia (6)
Ledum groenlandicum (7)
Vaccinum angustifolium (18)
Rhododendron canadense (10)
Pteridium aquilinum (33)
Cladonia arbuscula (93)
Cladonia alpestris (92)

Kalmia Heath (K) #33

Table 18. Diagrammatic key to the Hardwood Thickets and Heath types.

STAND STRUCTURE					
Dense Maple Thickets Herb Rich	Open Maple Thickets Sedge and Herb Rich	Alder Thickets on Moist Seepage Slopes	Alder Thickets on Floodplains or Bog Margins	Juvenile Hardwood Thickets on Cut and Burnt Forest Sites	Dwarf Shrub Thickets Dominated By *Kalmia angustifolia*(6)
DIFFERENTIAL SPECIES					
Sambucus pubens (16) *Galium kamtschaticum* (52) *Mitella nuda* (59)					
	Sanguisorba canadensis (63) *Senecio aureus* (64) *Aster puniceus* (46) *Solidago rugosa* (67)				
		Alnus rugosa (4) Dominant			
		Lycopodium lucidulum (36) *Lycopodium annotinum* (35)			
			Circaea alpina (48) *Habenaria dilatata* (56) *Geum rivale* (54) *Equisetum sylvaticum* (34)		
	Geum rivale (54) *Equisetum sylvaticum* (34)				
					Kalmia angustifolia (6) *Rhododendron canadense* (10) *Ledum groenlandicum* (7) *Pteridium aquilinum* (33) *Vaccinium angustifolium* (18) *Cladonia arbuscula* (93) *Cladonia alpestris* (92)
SOIL TYPE AND MOISTURE REGIME (MR)					
Gleyed Humic Podzol or Humic Gleysol With Mucky Surface	Terric Mesisol or Rego Gleysol-Deep Peat With Surface Seepage	Gleysol or Shallow Muck Soil With Seepage at 10-20cm	Alluvial Flood Plains Seasonally Innundated	Soils Variable-Usually Rich Moist Sites Not Poor Dry Sites	Soils Variable-Usually Poor Dry or Poor Wet Sites Rarely Rich Moist Sites
MR 4-5	MR 6	MR 4-5	MR 4-5	MR 3-4	MR 1-2
FOREST CLI CLASS AND SUBCLASS					
4w	7w	3w	7i	Variable	Variable
FOREST TYPE: SYMBOL AND FACT SHEET #					
Galium-Mountain Maple	Carex-Mountain Maple	Lycopodium-Alder Swamp	Alluvial-Alder Swamps	Birch Thickets	Kalmia Heath
Mg (#30)	Mc (Nil)	AL (#31)	Aa (Nil)	Bl (#32)	K (#33)

CHAPTER 4

FACT SHEETS 1-33

The fact sheets presented in this chapter provide a summary of the forest composition, site conditions and management interpretations for 29 forest types and 4 types of thicket vegetation found on forest sites throughout Newfoundland.

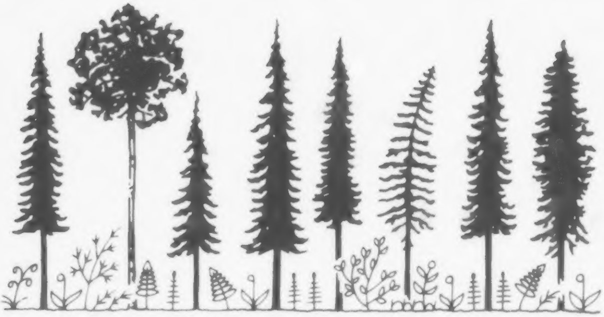
Major headings of the fact sheets are described in Chapter 2, including the rationale for management interpretations. The conventions used in soil profile descriptions, soil taxonomy, and the criteria used to determine soil moisture regime and soil texture are provided in Chapter 5. The topographic relationship of the types within various ecoregions of Newfoundland is illustrated with landtype cross-sections in Chapter 6.

Each fact sheet is composed of 2 pages: habitat conditions are presented on the left-hand page, while management interpretations are on the right-hand page. The forest type abbreviation and number (#) included in the succession table provides a reference to related forest types that may occupy similar site conditions after disturbance by fire, cutting, and severe insect infestation. The symbol **NC** indicates that, following the disturbance in question, there will be no significant change in forest type. An overall summary of successional relationships between forest types is given in Figure 3, Chapter 2.

A list of all abbreviations used in the fact sheets can be found, in alphabetical order, in Appendix A.

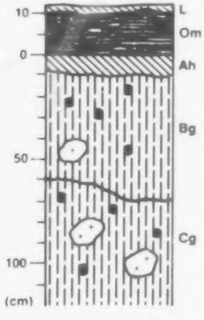
Equisetum-Rubus-Balsam Fir

SITE CONDITIONS

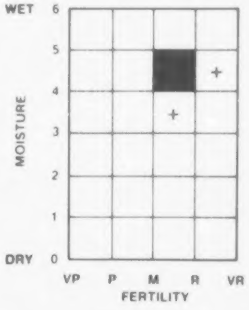


Site Conditions Lower concave slopes; somewhat wet to wet; loam to sandy loam; muck surface; shallow rooting; pH 4.5-4.7

Soil Types Fragic Humic Gleysol; Gleyed Regosol; Terric Mesisol



SOIL PROFILE



EDAPHIC GRID

MANAGEMENT INTERPRETATIONS

SUCCESSION

Region	Disturbance			
	Cutting	Fire	Insects	NSR
Western	NC	Br #28	NC	Mg #30
Central				
Northern	NC	Br #28	NC	Mg #30
Eastern				

PRODUCTIVITY

Region	CLI Class	CLI Subclass	Volume m^3/ha	SI 50 (breast height) m			
				bF	bS	wS	EST
Western	3	W	?	?	?	?	15.0
Central							
Northern	4	W	?	?	?	?	11.0
Eastern							

HARVESTING INTERPRETATIONS

Interpretations	Slope Class (%)					
	0-5	6-15	16-30	31-45	46-60	60 +
Harvesting Sensitivity	3	3	3	4		
Trafficability	M	M	L	L		
Road Suitability	L	L	L	L		

Compaction Hazard: H

SILVICULTURAL INTERPRETATIONS

Species Suitability						Natural Regen-Potential	
bS	wS	L	P	bF	yB	Cut	M: bF, bS
S	MD	MD	LD	S	LD	Fire	L: bS, wB

Topographic Position	Frost Heave Hazard	Windthrow Hazard
Uplands	M	H
Slopes	M	M
Valleys	H	M

Comments

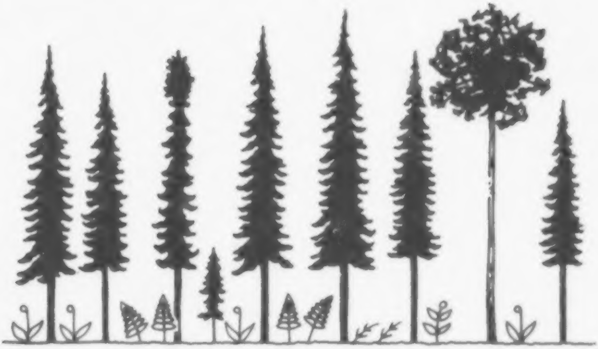
Wet, very productive, nutrient rich sites with a tendency to develop into Mg (#30) vegetation after cutting. Occurs in Northern Peninsula and Western Newfoundland Ecoregions.

Vegetation Competition Hazard (NSR Sites)

Region	Species							
	wB	tA	pC	mM	A	R	K	G-S
Western	H	X	L	H	M	M	L	H
Central								
Northern	M	X	L	H	L	M	L	H
Eastern								

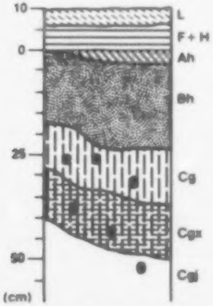
Rubus-Balsam Fir

SITE CONDITIONS

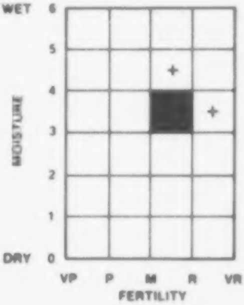


Site Conditions Lower slopes; somewhat moist to moist; loam to sandy loam; seepage at 30-50 cm; rooting 15-30 cm; pH 4.5-4.7 (6.5)

Soil Types Fragic Humic Podzol; Gleyed Ferro-Humic Podzol; Orthic Gleysol


10
0
25
50
(cm)
L
F + H
Ah
Bh
Cg
Cgx
Cgl

SOIL PROFILE



EDAPHIC GRID

MANAGEMENT INTERPRETATIONS

SUCCESSION

Region	Disturbance			
	Cutting	Fire	Insects	NSR
Western	NC	Br #27	NC	Mg #30
Central	NC	SM/M #17	NC	AL #31
Northern	NC	Br #27	NC	Bl #32
Eastern	NC	Br #27	NC	Bl #32

PRODUCTIVITY

Region	CLI Class	CLI Subclass	Volume m^3/ha	SI 50 (breast height) m			
				bF	bS	wS	EST
Western	3-4	S	?	?	?	?	15.4
Central	3-4	W	283.8	13.1	?	13.0	
Northern	3-4	S	154.0	11.5	?	?	
Eastern	4-5	SU	111.9	10.8	?	10.5	

HARVESTING INTERPRETATIONS

Interpretations	Slope Class (%)					
	0-5	6-15	16-30	31-45	46-60	60 +
Harvesting Sensitivity	3	3	3	4		
Trafficability	H	H	M	M		
Road Suitability	L	L	L	L		

Compaction Hazard : H

SILVICULTURAL INTERPRETATIONS

Species Suitability						Natural Regen-Potential	
bS	wS	L	P	bF	yB	Cut	M: bF, bS
S	MD	S	LD	S	S	Fire	L: bS, wB

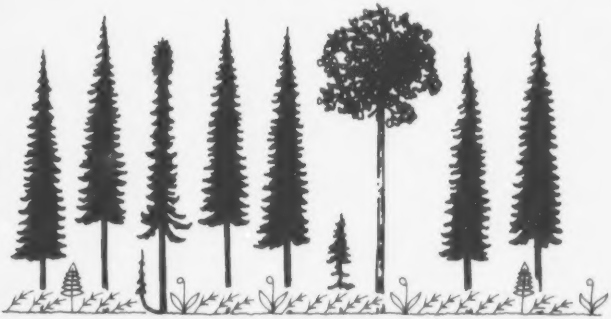
Topographic Position	Frost Heave Hazard	Windthrow Hazard
Uplands	L	M
Slopes	M	L
Valleys	H	L

Comments :
Highly productive forests on moist sites with a tendency to develop into Br (#27) and Mg (#30) vegetation after cutting and fire. Occurs in all ecoregions.

Vegetation Competition Hazard (NSR Sites)

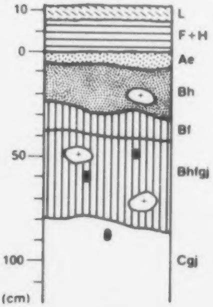
Region	Species							
	wB	tA	pC	mM	A	R	K	G-S
Western	H	X	M	H	M	H	X	M
Central	H	H	M	L	H	H	X	M
Northern	M	X	L	M	L	H	X	M
Eastern	M	X	L	X	L	H	X	M

SITE CONDITIONS

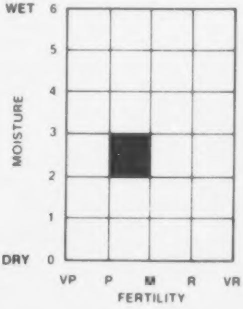


Site Conditions Mid slopes; somewhat moist; sandy loam to loamy sand; LFH 10-15 cm; rooting 40-50 cm; pH 4.3-4.8

Soil Types Gleyed Ferro-Humic Podzol; Orthic Ferro-Humic Podzol; Orthic Humic Podzol


10
0
50
100
(cm)
L
F+H
Ae
Bh
Bf
Bhfgj
Cgj

SOIL PROFILE



EDAPHIC GRID

MANAGEMENT INTERPRETATIONS

SUCCESSION

Region	Disturbance			
	Cutting	Fire	Insects	NSR
Western				
Central				
Northern	NC	SM/D #15	NC	K #33
Eastern	NC	SM/D #15	NC	K #33

PRODUCTIVITY

Region	CLI Class	CLI Subclass	Volume m^3/ha	SI 50 (breast height) m			
				bF	bS	wS	EST
Western							
Central							
Northern	4	M	168.2	7.9	?	?	
Eastern	5	F	179.2	11.9	9.2	?	

HARVESTING INTERPRETATIONS

Interpretations	Slope Class (%)					
	0-5	6-15	16-30	31-45	46-60	60 +
Harvesting Sensitivity	2	2	3	3		
Trafficability	H	H	H	M		
Road Suitability	M	M	M	M		

Compaction Hazard: M

SILVICULTURAL INTERPRETATIONS

Species Suitability						Natural Regen-Potential	
bS	wS	L	P	bF	yB	Cut	H: bF
MD	LD	S	S	MD	LD	Fire	M: bS

Topographic Position	Frost Heave Hazard	Windthrow Hazard
Uplands	L	M
Slopes	L	L
Valleys	M	L

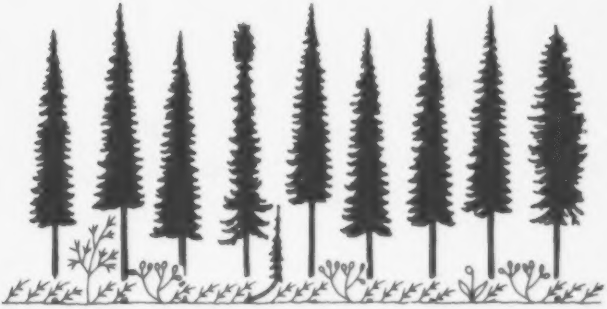
Comments:

This type occurs primarily in the eastern and northern ecoregions.

Vegetation Competition Hazard (NSR Sites)

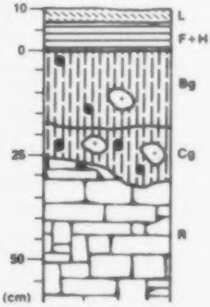
Region	Species							
	wB	tA	pC	mM	A	R	K	G-S
Western								
Central								
Northern	L	X	L	X	X	M	M	X
Eastern	L	X	L	X	X	L	M	X

SITE CONDITIONS

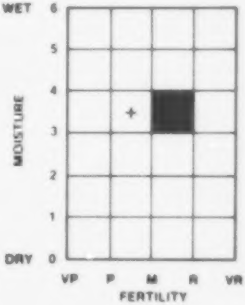


Site Conditions Mid to lower slopes: shallow till over calcarenus bedrock: moist rocky silt loams: LFH 10-15 cm: rooting 20-30 cm: pH 4.2-5.0 (6.5 in C)

Soil Types Orthic Gleysol: Rego Gleysol: Gleyed Ferro-Humic Podzol



SOIL PROFILE



EDAPHIC GRID

MANAGEMENT INTERPRETATIONS

SUCCESSION

Region	Disturbance			
	Cutting	Fire	Insects	NSR
Western	NC	SM/M #17	NC	Bt #32
Central				
Northern	NC	SM/M #17	NC	Bt #32
Eastern				

PRODUCTIVITY

Region	CLI Class	CLI Subclass	Volume m^3/ha	SI 50 (breast height) m			
				bF	bS	wS	EST
Western	4-5	S					15.0
Central							
Northern	5	MR	243	10.7	?	?	
Eastern							

HARVESTING INTERPRETATIONS

Interpretations	Slope Class (%)					
	0-5	6-15	16-30	31-45	46-60	60 +
Harvesting Sensitivity	3	3	3	4		
Trafficability	H	H	H	M		
Road Suitability	M	M	M	M		

Compaction Hazard : H

SILVICULTURAL INTERPRETATIONS

Species Suitability						Natural Regen-Potential	
bS	wS	L	P	bF	yB	Cut	H: bF
MD	MD	S	LD	S	LD	Fire	L: bS

Topographic Position	Frost Heave Hazard	Windthrow Hazard
Uplands	L	L
Slopes	L	L
Valleys	L	L

Comments :

The Ft type is usually associated with a somewhat poor, open *Epigaea* Subtype, having a deep raw humus layer and more bS.

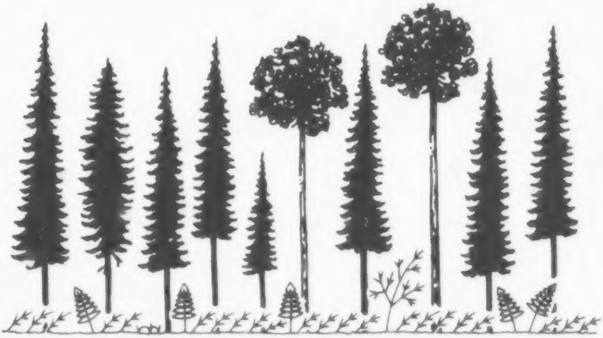
bF regen sometimes poor in Northern Peninsula Ecoregion.

Vegetation Competition Hazard (NSR Sites)

Region	Species							
	wB	tA	pC	mM	A	R	K	G-S
Western	M	X	L	L	X	M	X	L
Central								
Northern	L	X	L	M	X	M	X	L
Eastern								

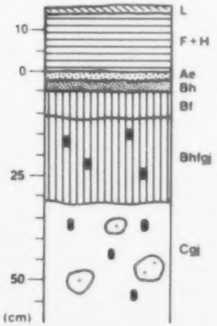
Dryopteris-Hylocomium-Balsam Fir

SITE CONDITIONS

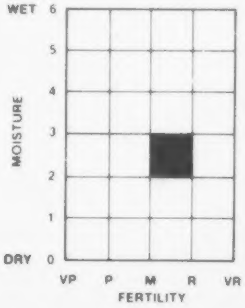


Site Conditions Mid to upper slopes; well drained to somewhat moist; deep sandy loam; organic horizon 15-25 cm; faint mottling; rooting 50 cm; pH 4.5-4.9

Soil Types Orthic Ferro-Humic Podzol; Fragic Ferro-Humic Podzol



SOIL PROFILE



EDAPHIC GRID

MANAGEMENT INTERPRETATIONS

SUCCESSION

Region	Disturbance			
	Cutting	Fire	Insects	NSR
Western	NC	Bdc #25	NC	Bt #32
Central				
Northern				
Eastern	NC	Bd #28	NC	Bt #32

PRODUCTIVITY

Region	CLI Class	CLI Subclass	Volume m^3/ha	SI 50 (breast height) m			
				bF	bS	wS	EST
Western	3-4	M	209	15.2	13.1	?	
Central							
Northern							
Eastern	5	F	?	?	?	?	12.0

HARVESTING INTERPRETATIONS

Interpretations	Slope Class (%)					
	0-5	6-15	16-30	31-45	46-60	60 +
Harvesting Sensitivity	1	1	2	3		
Trafficability	H	H	M	M		
Road Suitability	M	M	M	M		

Compaction Hazard : L

SILVICULTURAL INTERPRETATIONS

Species Suitability						Natural Regen-Potential	
bS	wS	L	P	bF	yB	Cut	H: bF
MD	MD	LD	LD	S	S	Fire	L: bS

Topographic Position	Frost Heave Hazard	Windthrow Hazard
Uplands	L	L
Slopes	L	L
Valleys	M	L

Comments :

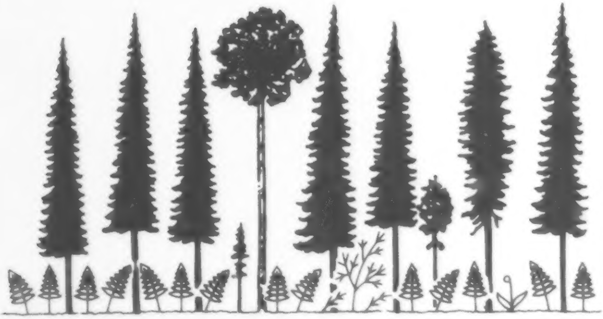
Most common forest type in western Nfld on well drained sites. Often overstocked after logging.

Vegetation Competition Hazard (NSR Sites)

Region	Species							
	wB	tA	pC	mM	A	R	K	G-S
Western	M	X	M	L	X	H	X	X
Central								
Northern								
Eastern	M	X	M	X	X	H	L	X

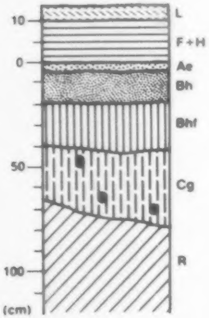
Dryopteris-Balsam Fir

SITE CONDITIONS

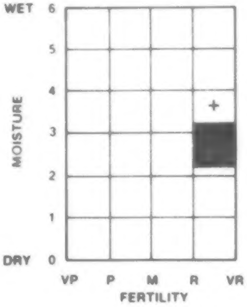


Site Conditions: Mid to upper slopes; somewhat moist; silt loam to sandy loam; seepage 40 cm; organic horizon 10-20 cm; rooting 50 cm; pH 5.0-5.5

Soil Types: Fragic Humic Podzol; Gleyed Ferro-Humic Podzol; Lithic Ferro-Humic Podzol



SOIL PROFILE



EDAPHIC GRID

MANAGEMENT INTERPRETATIONS

SUCCESSION

Region	Disturbance			
	Cutting	Fire	Insects	NSR
Western	NC	Bd #28	NC	Bt #32
Central				
Northern	NC	Bd #28	NC	Bt #32
Eastern	NC	Bd #28	NC	Bt #32

PRODUCTIVITY

Region	CLI Class	CLI Subclass	Volume m^3/ha	SI 50 (breast height) m			
				bF	bS	wS	EST
Western	2-3	C	231	18.8	15.2		
Central							
Northern	3-4	F	150	9.2	?	?	
Eastern	4	F	94	13.1	?	?	

HARVESTING INTERPRETATIONS

Interpretations	Slope Class (%)					
	0-5	6-15	16-30	31-45	46-60	60 +
Harvesting Sensitivity	3	3	3	4	4	5
Trafficability	H	H	M	M	L	L
Road Suitability	L	L	L	L	L	L

Compaction Hazard : H

SILVICULTURAL INTERPRETATIONS

Species Suitability						Natural Regen-Potential	
bS	wS	L	P	bF	yB	Cut	H: bF, wB yB
S	MD	S	LD	MD	MD	Fire	L: bS

Topographic Position	Frost Heave Hazard	Windthrow Hazard
Uplands	M	H
Slopes	M	M
Valleys	H	L

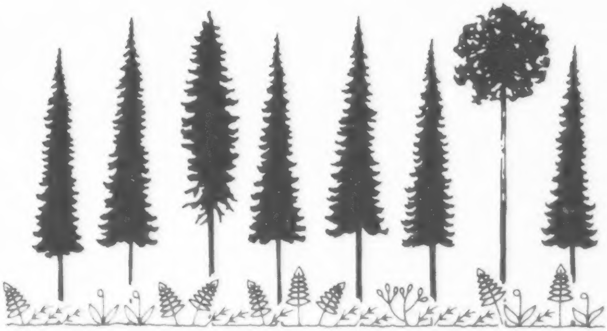
Comments :
Very productive forest type sometimes understocked to conifer. Absent from the Central Newfoundland Ecoregion. In eastern Nfld, a *Bazzania* variant with *Dryopteris spinulosa* var. *intermedia* (31) occurs.

Vegetation Competition Hazard (NSR Sites)

Region	Species							
	wB	tA	pC	mM	A	R	K	G-S
Western	H	X	L	L	X	H	X	L
Central								
Northern	H	X	L	L	X	H	X	L
Eastern	H	X	L	X	X	H	X	L

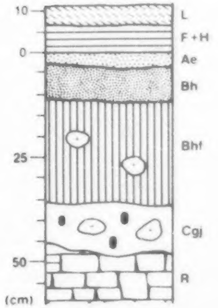
Dryopteris-Rhytidiadelphus-Balsam Fir

SITE CONDITIONS

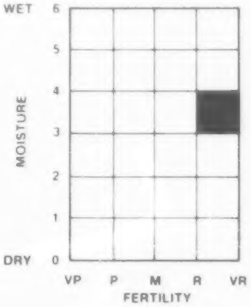


Site Conditions Undulating till over calcareous bedrock; somewhat moist to moist; organic horizon 10-15 cm; rooting 40-50 cm; pH 4.2-4.8 (6.5 in C)

Soil Types Orthic Ferro-Humic Podzol, Orthic Humic Podzol, Orthic Humic Regosol



SOIL PROFILE



EDAPHIC GRID

MANAGEMENT INTERPRETATIONS

SUCCESSION

Region	Disturbance			
	Cutting	Fire	Insects	NSR
Western	NC	Bd #28	Bd #28?	Bt #32
Central				
Northern				
Eastern				

PRODUCTIVITY

Region	CLI Class	CLI Subclass	Volume m^3/ha	SI 50 (breast height) m			
				bF	bS	wS	EST
Western	3-4	S	264	15.2	13.1	?	
Central							
Northern							
Eastern							

HARVESTING INTERPRETATIONS

Interpretations	Slope Class (%)					
	0-5	6-15	16-30	31-45	46-60	60 +
Harvesting Sensitivity	3	3	3	4	4	5
Trafficability	H	H	M	M	M	L
Road Suitability	M	M	L	L	L	L

Compaction Hazard : M

SILVICULTURAL INTERPRETATIONS

Species Suitability						Natural Regen-Potential	
bS	wS	L	P	bF	yB	Cut	M: bF
S	MD	S	LD	MD	S	Fire	L: bS

Topographic Position	Frost Heave Hazard	Windthrow Hazard
Uplands	M	H
Slopes	M	M
Valleys	H	M

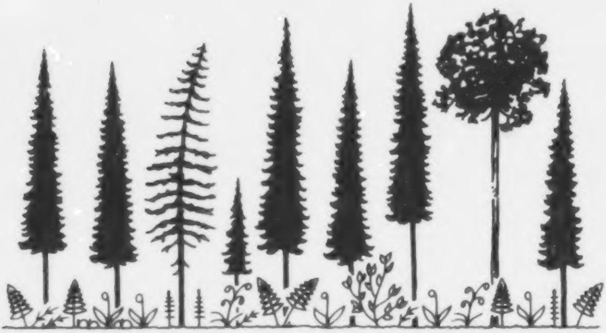
Comments :
One of the most productive forest types in western Nfld, usually on calcareous soils. Western Newfoundland Ecoregion only.

Vegetation Competition Hazard (NSR Sites)

Region	Species							
	wB	tA	pC	mM	A	R	K	G-S
Western	H	X	M	M	X	H	X	L
Central								
Northern								
Eastern								

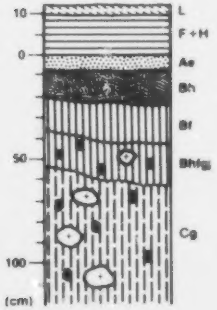
Dryopteris-Lycopodium-Balsam Fir

SITE CONDITIONS

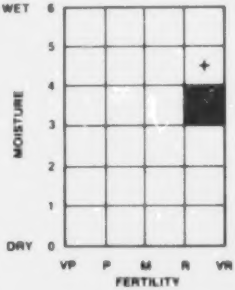


Site Conditions Hummocky moraine near bogs; moist; sandy loam or loamy sand; LFH 10-20 cm; roots 20-25 cm; pH 4.5-4.8

Soil Types Orthic Humic Podzol; Placic Humic Podzol; Gleyed Ferro-Humic Podzol


10
0
50
100
(cm)
L
F+H
Ae
Bh
Bf
Bhfgj
Cg

SOIL PROFILE



EDAPHIC GRID

MANAGEMENT INTERPRETATIONS

SUCCESSION

Region	Disturbance			
	Cutting	Fire	Insects	NSR
Western				
Central	NC	BIA #24	BIA #24?	AL #31
Northern				
Eastern				

PRODUCTIVITY

Region	CLI Class	CLI Subclass	Volume m^3/ha	SI 50 (breast height) m			
				bF	bS	wS	EST
Western							
Central	2-3	CW	286	13.9	?	?	
Northern							
Eastern							

HARVESTING INTERPRETATIONS

Interpretations	Slope Class (%)					
	0-5	6-15	16-30	31-45	46-60	60 +
Harvesting Sensitivity	3	3	3	4	4	5
Trafficability	M	M	L	L	L	L
Road Suitability	L	L	L	L	L	L

Compaction Hazard : H

SILVICULTURAL INTERPRETATIONS

Species Suitability						Natural Regen-Potential	
bS	wS	L	P	bF	yB	Cut	M: bF, wS
S	MD	S	LD	MD	LD	Fire	L: bS

Topographic Position	Frost Heave Hazard	Windthrow Hazard
Uplands	M	H
Slopes	L	H
Valleys	L	M

Comments :

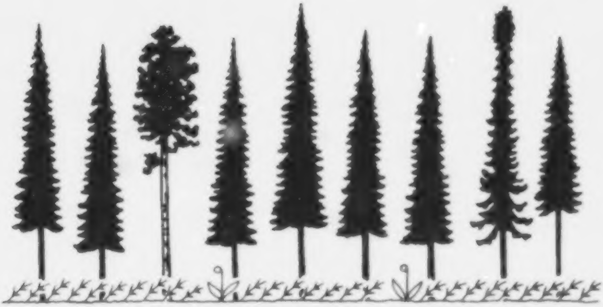
This is the most productive forest type in central Nfld. It transcends somewhat wet soils where succession to alder vegetation may occur after fire and logging.

Vegetation Competition Hazard (NSR Sites)

Region	Species							
	wB	tA	pC	mM	A	R	K	G-S
Western								
Central	H	H	L	L	H	H	X	H
Northern								
Eastern								

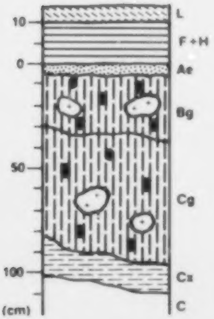
Hylocomium-Balsam Fir

SITE CONDITIONS

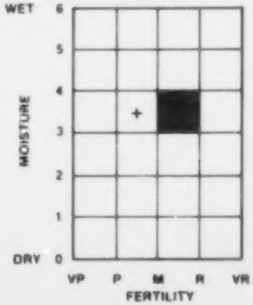


Site Conditions Mid to upper slopes; moist; loam to silt loam; seepage over fragipan; LFH 10-15 cm; rooting 40-50 cm; pH 4.4-4.7

Soil Types: Orthic Gleysol; Orthic Humic Gleysol; Rego Gleysol



SOIL PROFILE



EDAPHIC GRID

MANAGEMENT INTERPRETATIONS

SUCCESSION

Region	Disturbance			
	Cutting	Fire	Insects	NSR
Western	NC	SM/M #17	NC	Bt #32
Central	NC	SM/M #17	NC	Bt #32
Northern				
Eastern	NC	SM/M #17	NC	K #33

PRODUCTIVITY

Region	CLI Class	CLI Subclass	Volume m^3/ha	SI 50 (breast height) m			
				bF	bS	wS	tL
Western	4 5	F	228	12.8	12.0	12.0	15.2
Central	4	F	215	13.0	11.0	?	15.2
Northern							
Eastern	5	F	186	11.9	11.1	?	

HARVESTING INTERPRETATION:

Interpretations	Slope Class (%)					
	0-5	6-15	16-30	31-45	46-60	60 +
Harvesting Sensitivity	3	3	3	4	4	5
Trafficability	M	M	L	L	L	L
Road Suitability	M	M	L	L	L	L

Compaction Hazard: H

SILVICULTURAL INTERPRETATIONS

Species Suitability						Natural Regen-Potential	
bS	wS	L	P	bF	yB	Cut	H: bF
MD	S	S	LD	MD	LD	Fire	M: bS

Topographic Position	Frost Heave Hazard	Windthrow Hazard
Uplands	M	H
Slopes	H	M
Valleys	H	M

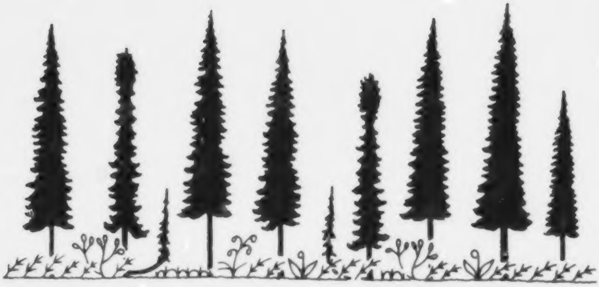
Comments

Transitions between Fh (#9) and Fp (#11) are common and are usually found on soils with a well-drained Bhf horizon (10-20cm) over a Bhfgj. The topographic position is quite different between the Western and Central Newfoundland Ecoregions.

Vegetation Competition Hazard (NSR Sites)

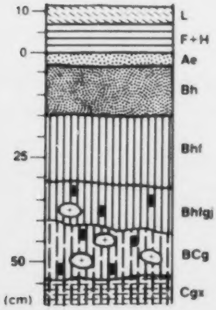
Region	Species							
	wB	tA	pC	mM	A	R	K	G-S
Western	H	X	L	L	M	M	L	M
Central	H	H	L	L	M	M	L	M
Northern								
Eastern	M	X	L	X	L	M	M	L

SITE CONDITIONS

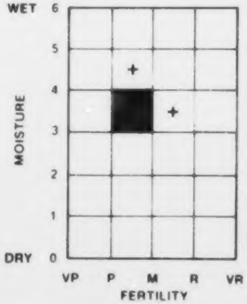


Site Conditions Midslope; somewhat moist to moist; loam to silt loam; seepage on fragipan; organic layer (or muck) 10-15 cm; gleyed; roots 20-40 cm; pH 5.0-5.5

Soil Types Fragic Humic Podzol; Orthic Humic Gleysol; Rego Humic Gleysol


10
0
25
50
(cm)
L
F+H
Ae
Bh
Bhf
Bhfgj
BCg
Cgx

SOIL PROFILE



EDAPHIC GRID

MANAGEMENT INTERPRETATIONS

SUCCESSION

Region	Disturbance			
	Cutting	Fire	Insects	NSR
Western	NC	SM/B #16	SM/B #16	SKn #22
Central				
Northern				
Eastern				

PRODUCTIVITY

Region	CLI Class	CLI Subclass	Volume m^3/ha	SI 50 (breast height) m			
				bF	bS	wS	EST
Western	5	FW	?	?	?	?	11.0
Central							
Northern							
Eastern							

HARVESTING INTERPRETATIONS

Interpretations	Slope Class (%)					
	0-5	6-15	16-30	31-45	46-60	60 +
Harvesting Sensitivity	2	2	3	4		
Trafficability	M	M	L	L		
Road Suitability	M	M	L	L		

Compaction Hazard : H

SILVICULTURAL INTERPRETATIONS

Species Suitability						Natural Regen-Potential	
bS	wS	L	P	bF	yB	Cut	L: bS
MD	LD	MD	LD	S	LD	Fire	M: bS

Topographic Position	Frost Heave Hazard	Windthrow Hazard
Uplands	M	H
Slopes	H	H
Valleys	H	M

Comments :

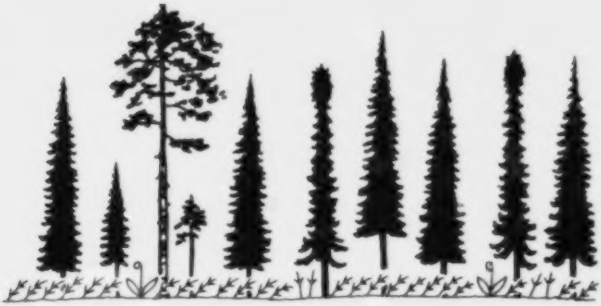
Moderately productive stands sometimes with a deep duff layer. This type is restricted to western Nfld. but very similar to the SM/B (#16) in central Nfld.

Vegetation Competition Hazard (NSR Sites)

Region	Species							
	wB	tA	pC	mM	A	R	K	G-S
Western	L	X	X	X	M	L	H	H
Central								
Northern								
Eastern								

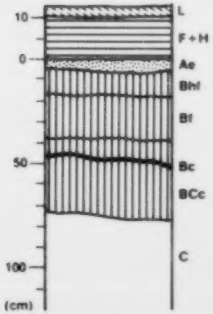
Pleurozium-Balsam Fir

SITE CONDITIONS

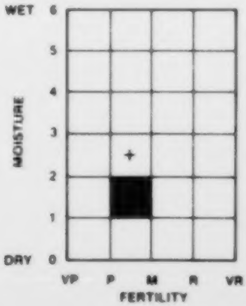


Site Conditions Upper slopes and ridge summits; dry to well drained; loamy sand to sandy loam; LFH 10-20 cm; rooting 30-40 cm; pH 3.8-4.2

Soil Types Placic Ferro-Humic Podzol; Orthic Ferro-Humic Podzol; Ortstein Ferro-Humic Podzol; Orthic Humo-Ferric Podzol; Ortstein Humo-Ferric Podzol.



SOIL PROFILE



EDAPHIC GRID

MANAGEMENT INTERPRETATIONS

SUCCESSION

Region	Disturbance			
	Cutting	Fire	Insects	NSR
Western	NC	SM/D #15	NC	K #33
Central	NC	SM/D #15	NC	K #33
Northern	NC	SM/D #15	NC	K #33
Eastern	NC	SM/D #15	NC	K #33

PRODUCTIVITY

Region	CLI Class	CLI Subclass	Volume m^3/ha	SI 50 (breast height) m			
				bF	bS	wS	rP
Western	5	MF	?	12.0	?	?	17.0
Central	5	MF	212	11.6	?	12.1	17.0
Northern	5	MF	103	6.7	6.7	?	?
Eastern	5-6	MFU	199.4	11.6	9.5	?	?

HARVESTING INTERPRETATIONS

Interpretations	Slope Class (%)					
	0-5	6-15	16-30	31-45	46-60	60 +
Harvesting Sensitivity	1	1	2	2	3	4
Trafficability	H	H	H	H	M	L
Road Suitability	H	H	H	H	M	L

Compaction Hazard : L

SILVICULTURAL INTERPRETATIONS

Species Suitability						Natural Regen-Potential	
bS	wS	L	P	bF	yB	Cut	H: bF
MD	LD	LD	MD	S	LD	Fire	M: bS

Topographic Position	Frost Heave Hazard	Windthrow Hazard
Uplands	L	M
Slopes	L	L
Valleys	L	L

Comments :

This type is common in the Central Newfoundland Ecoregion but rare in the Western Newfoundland Ecoregion, except for the St. George's Coastal Plain.

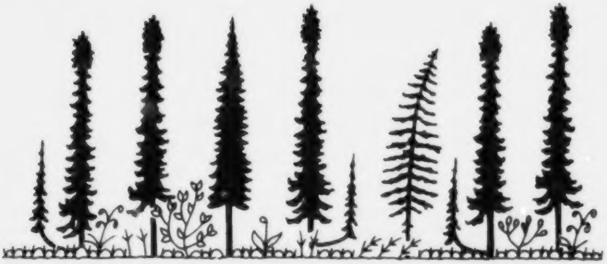
bF regen sometimes poor in Northern Peninsula Ecoregion.

Vegetation Competition Hazard (NSR Sites)

Region	Species							
	wB	tA	pC	mM	A	R	K	G-S
Western	L	X	L	X	X	L	H	X
Central	L	L	L	X	X	L	H	X
Northern	L	X	L	X	X	L	H	X
Eastern	L	X	L	X	X	L	H	X

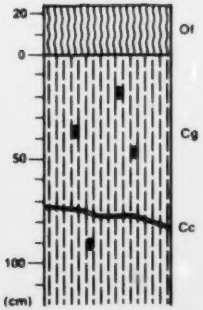
Sphagnum-Black Spruce

SITE CONDITIONS

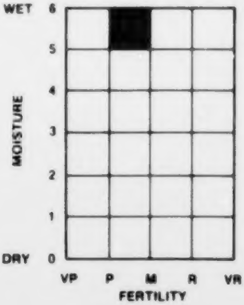


Site Conditions : Low slopes transitional to open bog; somewhat wet to wet; often bog surface on permanently wet soils; organic layer 15-30 cm; roots 10-20 cm.

Soil Types : Rego Gleysol; Typic or Mesic Fibrisol.



SOIL PROFILE



EDAPHIC GRID

MANAGEMENT INTERPRETATIONS

SUCCESSION

Region	Disturbance			
	Cutting	Fire	Insects	NSR
Western	SKn #22	NC	SKn #22	K #33
Central				
Northern	SKn #22	NC	SKn #22	K #33
Eastern	SKn #22	NC	SKn #22	K #33

PRODUCTIVITY

Region	CLI Class	CLI Subclass	Volume m^3/ha	SI 50 (breast height) m			
				bF	bS	wS	EST
Western	7	FW	?	?	?	?	10.0
Central							
Northern	6	FW	?	?	?	?	7.0
Eastern	7	FW	?	?	?	?	7.0

HARVESTING INTERPRETATIONS

Interpretations	Slope Class (%)					
	0-5	6-15	16-30	31-45	46-60	60 +
Harvesting Sensitivity	3	3	4	4	5	5
Trafficability	0	0	0	0	0	0
Road Suitability	L	L	L	L	L	L

Compaction Hazard : H

SILVICULTURAL INTERPRETATIONS

Species Suitability						Natural Regen-Potential	
bS	wS	L	P	bF	yB	Cut	L: bS
MD	LD	MD	LD	S	LD	Fire	L: bS

Topographic Position	Frost Heave Hazard	Windthrow Hazard
Uplands	H	H
Slopes	H	M
Valleys	H	M

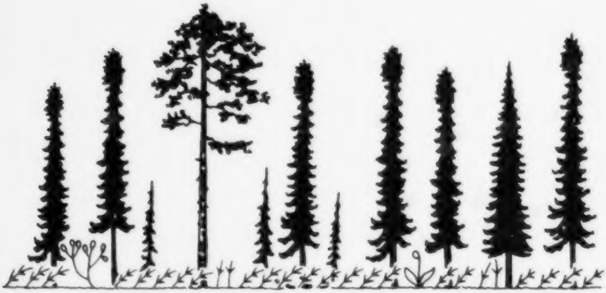
Comments :
Marginally productive sites with severe operational limitations, winter logging best choice.

Vegetation Competition Hazard (NSR Sites)

Region	Species							
	wP	tA	pC	mM	A	R	K	G-S
Western	L	X	X	M	M	X	H	H
Central								
Northern	L	X	X	L	M	X	H	H
Eastern	L	X	X	X	M	X	H	H

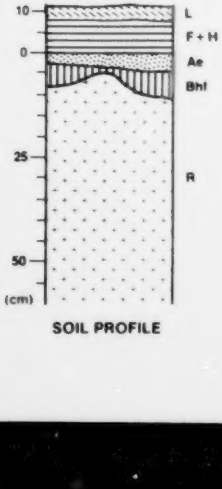
Black Spruce-Feathermoss/Bedrock

SITE CONDITIONS

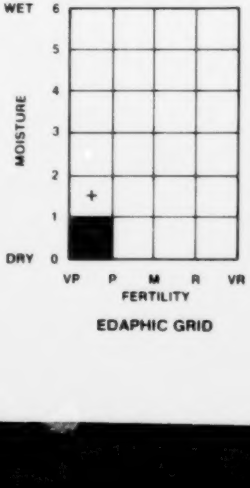


Site Conditions Summit of ridges; dry to well drained; coarse fragments over bedrock; LFH 10-20 cm; rooting 10-20 cm; pH 4.2-4.4

Soil Types Typic Folisol; Lithic Orthic Regosol.



SOIL PROFILE



EDAPHIC GRID

MANAGEMENT INTERPRETATIONS

SUCCESSION

Region	Disturbance			
	Cutting	Fire	Insects	NSR
Western	SK #20	NC	SK #20	K #33
Central	SK #20	NC	SK #20	K #33
Northern	SK #20	NC	SK #20	K #33
Eastern	SK #20	NC	SK #20	K #33

PRODUCTIVITY

Region	CLI Class	CLI Subclass	Volume m^3/ha	SI 50 (breast height) m			
				bF	bS	rP	EST
Western	6	R	?	?	?	8.0	7.0
Central	6	R	?	?	?	8.0	7.0
Northern	7	RU	?	?	?	?	6.0
Eastern	7	RU	?	?	?	?	6.0

HARVESTING INTERPRETATIONS

Interpretations	Slope Class (%)					
	0-5	6-15	16-30	31-45	46-60	60 +
Harvesting Sensitivity	2	2	2	2	3	3
Trafficability	H	H	H	H	M	L
Road Suitability	H	H	H	H	L	L

Compaction Hazard : L

SILVICULTURAL INTERPRETATIONS

Species Suitability						Natural Regen-Potential	
bS	wS	L	P	bF	yB	Cut	L: bS
S	LD	LD	MD	LD	LD	Fire	L: bS

Topographic Position	Frost Heave Hazard	Windthrow Hazard
Uplands	L	H
Slopes	L	H
Valleys	L	M

Comments :

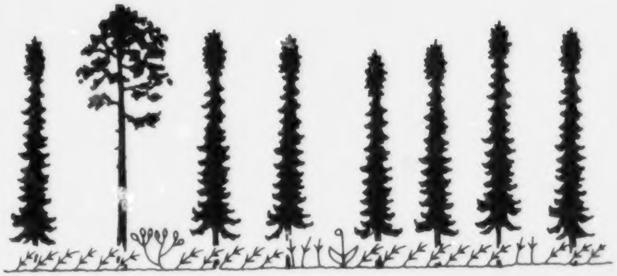
Stable Black Spruce type, very slow to recover following disturbance by fire or cutting.

Vegetation Competition Hazard (NSR Sites)

Region	Species							
	wB	tA	pC	mM	A	R	K	G-S
Western	L	X	L	X	L	L	H	X
Central	L	L	L	X	L	L	H	X
Northern	L	X	L	X	L	L	H	X
Eastern	L	X	L	X	L	L	H	X

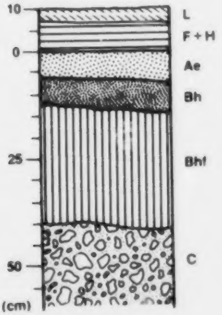
Black Spruce-Feathermoss/Very Dry

SITE CONDITIONS

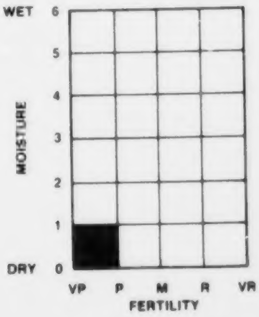


Site Conditions : Level outwash deposits; extremely dry to dry; coarse sand and gravel; LFH 5-10 cm; roots 30-40 cm; pH 4.5-4.8

Soil Types : Orthic Humo-Ferric Podzol; Placic Humo-Ferric Podzol; Ortstein Ferro-Humic Podzol



SOIL PROFILE



EDAPHIC GRID

MANAGEMENT INTERPRETATIONS

SUCCESSION

Region	Disturbance			
	Cutting	Fire	Insects	NSR
Western	SKc #21	NC	SKc #21	K #33
Central	SKc #21	NC	SKc #21	K #33
Northern	SKc #21	NC	SKc #21	K #33
Eastern	SKc #21	NC	SKc #21	K #33

PRODUCTIVITY

Region	CLI Class	CLI Subclass	Volume m^3/ha	SI 50 (breast height) m			
				bF	bS	rP	EST
Western	7	MD	?	?	?	13.0	9.0
Central	7	MD	?	?	?	13.0	9.0
Northern	7	MD	?	?	?	?	9.0
Eastern	7	MD	?	?	?	?	9.0

HARVESTING INTERPRETATIONS

Interpretations	Slope Class (%)					
	0-5	6-15	16-30	31-45	46-60	60 +
Harvesting Sensitivity	0	0	1	1		
Trafficability	H	H	H	M		
Road Suitability	H	H	H	H		

Compaction Hazard : L

SILVICULTURAL INTERPRETATIONS

Species Suitability						Natural Regen-Potential	
bS	wS	L	P	bF	yB	Cut	L: bS
S	LD	LD	MD	LD	LD	Fire	M: bS

Topographic Position	Frost Heave Hazard	Windthrow Hazard
Uplands	L	M
Slopes	L	L
Valleys	L	L

Comments :

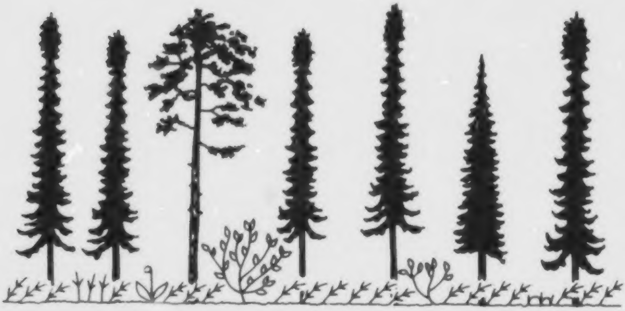
Stable Black Spruce type with poorly growing fir. Marginally productive except for rP and jP. Most common in the eastern part of the Central Newfoundland Ecoregion.

Vegetation Competition Hazard (NSR Sites)

Region	Species							
	wB	tA	pC	mM	A	R	K	G-S
Western	L	X	L	X	X	L	M	X
Central	L	L	L	X	X	L	M	X
Northern	L	X	L	X	X	L	M	X
Eastern	L	X	L	X	X	L	M	X

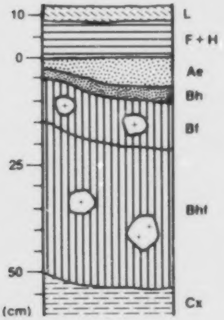
Black Spruce-Feathermoss/Dry

SITE CONDITIONS

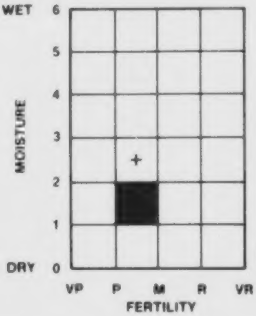


Site Conditions Level to slightly sloping summits; dry to well drained; sandy loams and loamy sands; LFH 10-15 cm; rooting 40-50 cm; pH 4.6-4.8

Soil Types Orthic Ferro-Humic Podzol; Placic Humo-Ferric Podzol; Fragic Ferro-Humic Podzol



SOIL PROFILE



EDAPHIC GRID

MANAGEMENT INTERPRETATIONS

SUCCESSION

Region	Disturbance			
	Cutting	Fire	Insects	NSR
Western	Fp #11	NC	SK #20	SK #20
Central	Fp #11	NC	SK #20	SK #20
Northern	Fp #11	NC	SK #20	SK #20
Eastern	Fp #11	NC	SK #20	SK #20

PRODUCTIVITY

Region	CLI Class	CLI Subclass	Volume m³ ha	SI 50 (breast height) m			
				bF	bS	rP	EST
Western	5	MF	?	?	?	17.0	12.0
Central	5	MF	152	11.8	?	17.0	
Northern	5	MF	?	?	?	?	6.7
Eastern	6	MF	?	?	?	?	9.5

HARVESTING INTERPRETATIONS

Interpretations	Slope Class (%)					
	0-5	6-15	16-30	31-45	46-60	60 +
Harvesting Sensitivity	1	1	2	2		
Trafficability	H	H	M	M		
Road Suitability	H	H	H	H		

Compaction Hazard : L

SILVICULTURAL INTERPRETATIONS

Species Suitability						Natural Regen-Potential	
bS	wS	L	P	bF	yB	Cut	M: bF
MD	LD	LD	S	S	LD	Fire	M: bS

Topographic Position	Frost Heave Hazard	Windthrow Hazard
Uplands	L	L
Slopes	L	L
Valleys	L	L

Comments :

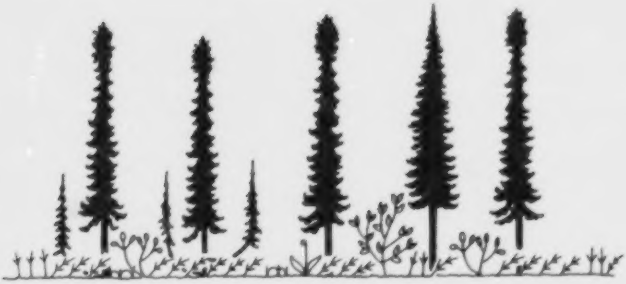
This type represents a fire subclimax on the Fp (#11) site type. Most common in central Nfld. Prone to *Kalmia* encroachment.

Vegetation Competition Hazard (NSR Sites)

Region	Species							
	wB	tA	pC	mM	A	R	K	G-S
Western	L	X	L	X	X	L	H	X
Central	L	L	L	X	X	L	H	
Northern	L	X	L	X	X	L	H	X
Eastern	L	X	L	X	X	L	H	X

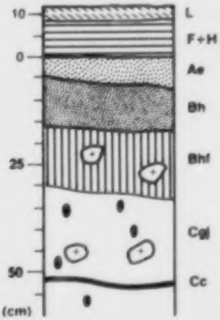
Black Spruce-Feathermoss/Bog

SITE CONDITIONS

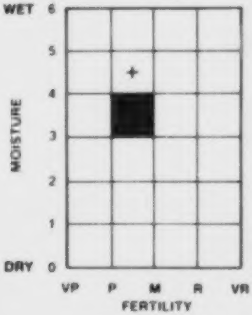


Site Conditions Till islands in large bogs; somewhat moist to moist; sandy loam to loamy sand; LFH 10-20 cm; roots 20-30 cm; pH 4.6-4.8

Soil Types Orthic Humic Podzol; Placic Humic Podzol; Fragic Humic Podzol



SOIL PROFILE



EDAPHIC GRID

MANAGEMENT INTERPRETATIONS

SUCCESSION

Region	Disturbance			
	Cutting	Fire	Insects	NSR
Western	SKn #22	NC	SKn #22	K #33
Central	SKs #23	NC	SKs #23	K #33
Northern				
Eastern				

PRODUCTIVITY

Region	CLI Class	CLI Subclass	Volume m^3/ha	SI 50 (breast height) m			
				bF	bS	wS	EST
Western	5	WF	?	?	?	?	11.0
Central	5	WF	?	?	?	?	11.0
Northern							
Eastern							

HARVESTING INTERPRETATIONS

Interpretations	Slope Class (%)					
	0-5	6-15	16-30	31-45	46-60	60 +
Harvesting Sensitivity	3	3	3	4		
Trafficability	M	M	L	L		
Road Suitability	M	M	L	L		

Compaction Hazard : H

SILVICULTURAL INTERPRETATIONS

Species Suitability						Natural Regen-Potential	
bS	wS	L	P	bF	yB		
MD	LD	S	LD	LD	LD	Cut	L: bS
						Fire	M: bS

Topographic Position	Frost Heave Hazard	Windthrow Hazard
Uplands	M	H
Slopes	M	M
Valleys	L	M

Comments

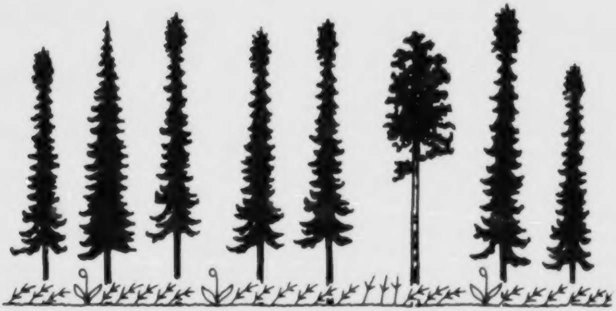
Uncommon, poor type associated with bog deposits; similar to the Gaultheria-bF (#10) type of the Western Newfoundland Ecoregion.

Vegetation Competition Hazard (NSR Sites)

Region	Species							
	wB	tA	pC	mM	A	R	K	G-S
Western	L	X	L	X	L	L	H	H
Central	L	L	L	X	L	L	H	H
Northern								
Eastern								

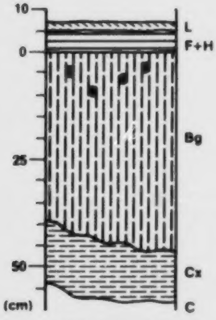
Black Spruce-Feathermoss/Moist

SITE CONDITIONS

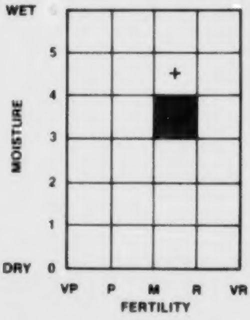


Site Conditions : Mid to upper slope; somewhat moist to moist; seepage; sandy loam to loam; LFH 5-10 cm; roots 10-25 cm; pH 4.5-4.8

Soil Types : Orthic Gleysol; Rego Gleysol; Gleyed Ferro-Humic Podzol



SOIL PROFILE



EDAPHIC GRID

MANAGEMENT INTERPRETATIONS

SUCCESSION

Region	Disturbance			
	Cutting	Fire	Insects	NSR
Western	Fh #9	NC	Fh #9	Bl #32
Central	Fh #9	NC	Fh #9	BlA #24
Northern				
Eastern	Fh #9	NC	Fh #9	Bl #32

PRODUCTIVITY

Region	CLI Class	CLI Subclass	Volume m^3/ha	SI 50 (breast height) m			
				bF	bS	tL	EST
Western	4	F	?	?	?	15.2	12.0
Central	4	F	?	?	?	15.2	12.0
Northern							
Eastern	5	F	?	?	?	?	11.1

HARVESTING INTERPRETATIONS

Interpretations	Slope Class (%)					
	0-5	6-15	16-30	31-45	46-60	60 +
Harvesting Sensitivity	3	3	4	4		
Trafficability	M	M	L	L		
Road Suitability	M	M	L	L		

Compaction Hazard : M

SILVICULTURAL INTERPRETATIONS

Species Suitability						Natural Regen-Potential	
bS	wS	L	P	bF	yB	Cut	M: bF, bS
MD	LD	MD	LD	S	LD	Fire	H: bS

Topographic Position	Frost Heave Hazard	Windthrow Hazard
Uplands	M	H
Slopes	H	H
Valleys	H	M

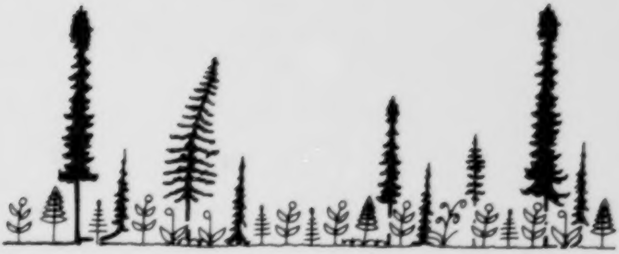
Comments :
Fire subclimax originating from Fh (#9) or Fr (#2) types. Succession to BlA (#24) or Br (#27) if softwood regeneration is lacking after fire or cutting.

Vegetation Competition Hazard (NSR Sites)

Region	Species							
	wB	tA	pC	mM	A	R	K	G-S
Western	M	X	L	L	L	H	L	M
Central	M	H	L	X	L	H	L	M
Northern								
Eastern	M	X	L	X	L	H	L	M

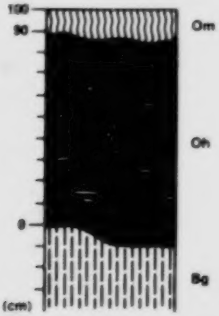
Carex-Black Spruce

SITE CONDITIONS

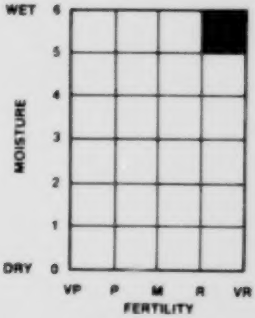


Site Conditions : Mid to lower slopes; somewhat wet to wet; loam to silt loam; deep organic soil 50-100 cm; roots near surface, 5-10 cm; pH 5.0-5.5

Soil Types : Terric Humisol; Typic Humisol; Rego Gleysol


100
90
0
(cm)
Om
Oh
Bg

SOIL PROFILE


WET
DRY
MOISTURE
6
5
4
3
2
1
0
VP
P
M
R
VR
FERTILITY

EDAPHIC GRID

MANAGEMENT INTERPRETATIONS

SUCCESSION

Region	Disturbance			
	Cutting	Fire	Insects	NSR
Western	Fen	NC	NC	Fen
Central	Fen	NC	NC	Fen
Northern	Fen	NC	NC	Fen
Eastern	Fen	NC	NC	Fen

PRODUCTIVITY

Region	CLI Class	CLI Subclass	Volume m³/ha	SI 50 (breast height) m			
				bF	bS	tL	EST
Western	7	FW	Non-merchantable			10.0	7.0
Central	7	FW	Non-merchantable			10.0	7.0
Northern	7	FW	Non-merchantable				7.0
Eastern	7	FW	Non-merchantable				7.0

HARVESTING INTERPRETATIONS

Interpretations	Slope Class (%)					
	0-5	6-15	16-30	31-45	46-60	60 +
Harvesting Sensitivity	4	4	4	5	5	5
Trafficability	O	O	O	O	O	O
Road Suitability	L	L	L	L	L	L

Compaction Hazard : H

SILVICULTURAL INTERPRETATIONS

Species Suitability						Natural Regen-Potential	
bS	wS	L	P	bF	yB	Cut	L: bS, tL
S	LD	MD	LD	LD	LD	Fire	M: bS, tL

Topographic Position	Frost Heave Hazard	Windthrow Hazard
Uplands	L	H
Slopes	L	H
Valleys	L	H

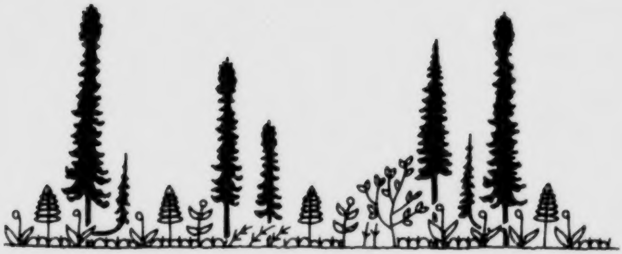
Comments :
Non-merchantable Fen type usually interspersed with productive types. Sensitive wildlife and plant habitat.

Vegetation Competition Hazard (NSR Sites)

Region	Species							
	wB	tA	pC	mM	A	R	K	G-S
Western	L	X	X	M	M	X	X	H
Central	L	L	X	X	M	X	X	H
Northern	L	X	X	M	M	X	X	H
Eastern	L	X	X	X	M	X	X	H

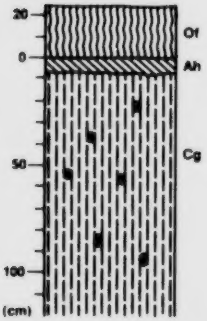
Osmunda-Black Spruce

SITE CONDITIONS

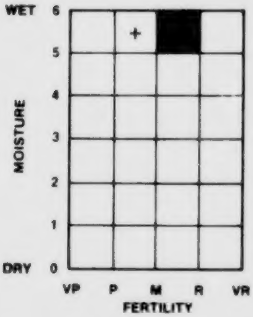


Site Conditions : Lower slopes and depressions; somewhat wet to wet; sandy loam to loam; organic layer 40-50 cm; roots 10-20 cm; pH 4.8-5.5

Soil Types : Orthic Humic Gleysol; Orthic Gleysol; Terric Mesisol.



SOIL PROFILE



EDAPHIC GRID

MANAGEMENT INTERPRETATIONS

SUCCESSION

Region	Disturbance			
	Cutting	Fire	Insects	NSR
Western	Fen	NC	NC	Fen
Central	Fen	NC	NC	Fen
Northern	Fen	NC	NC	Fen
Eastern	Fen	NC	NC	Fen

PRODUCTIVITY

Region	CLI Class	CLI Subclass	Volume m^3/ha	SI 50 (breast height) m			
				bF	bS	wS	EST
Western	7	FW		Non-merchantable			7.0
Central	7	FW		Non-merchantable			7.0
Northern	7	FW		Non-merchantable			7.0
Eastern	7	FW		Non-merchantable			7.0

HARVESTING INTERPRETATIONS

Interpretations	Slope Class (%)					
	0-5	6-15	16-30	31-45	46-60	60 +
Harvesting Sensitivity	4	4	4	5	5	5
Trafficability	O	O	O	O	O	O
Road Suitability	L	L	L	L	L	L

Compaction Hazard : H

SILVICULTURAL INTERPRETATIONS

Species Suitability						Natural Regen-Potential	
bS	wS	L	P	bF	yB	Cut	L: bS, tL
MD	LD	S	LD	LD	LD	Fire	M: bS, tL

Topographic Position	Frost Heave Hazard	Windthrow Hazard
Uplands	L	H
Slopes	L	H
Valleys	L	H

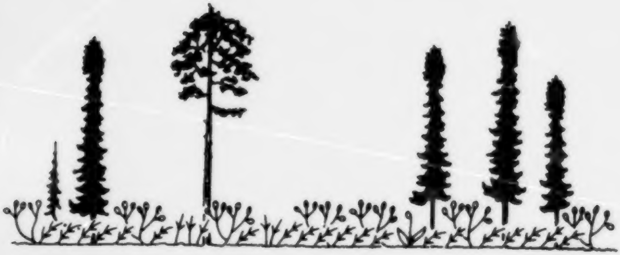
Comments :
Marginally productive; wet sites with severe limitations for harvesting and site preparation.

Vegetation Competition Hazard (NSR Sites)

Region	Species							
	wB	tA	pC	mM	A	R	K	G-S
Western	L	X	X	L	M	L	L	H
Central	L	L	X	X	M	L	L	H
Northern	L	X	X	L	M	L	L	H
Eastern	L	X	X	X	M	L	L	H

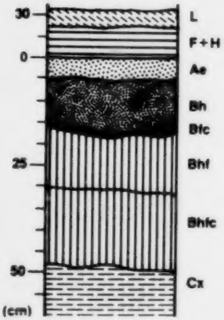
Kalmia-Black Spruce

SITE CONDITIONS

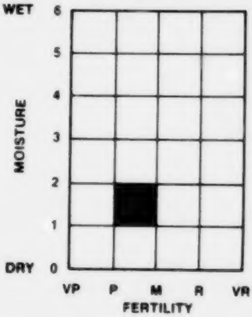


Site Conditions: Upper slopes and ridge tops; dry to well drained; sandy loam and loamy sand; LFH 30-40 cm; roots 20-30 cm; pH 4.6-4.8

Soil Types: Orthic Humo-Ferric Podzol; Placic Humo-Ferric Podzol


30
0
25
50
(cm)
L
F+H
Ae
Bh
Bfc
Bhf
Bhfc
Cx

SOIL PROFILE



EDAPHIC GRID

MANAGEMENT INTERPRETATIONS

SUCCESSION

Region	Disturbance			
	Cutting	Fire	Insects	NSR
Western	K #33	SM/D #15	NC	K #33
Central	K #33	SM/D #15	NC	K #33
Northern	K #33	SM/D #15	NC	K #33
Eastern	K #33	SM/D #15	NC	K #33

PRODUCTIVITY

Region	CLI Class	CLI Subclass	Volume m^3/ha	SI 50 (breast height) m			
				bF	bS	tL	EST
Western	5	MF	?	?	?	10.5	10.5
Central	5	MF	?	?	?	10.5	10.5
Northern	5	MF	?	?	?	?	10.5
Eastern	5	MF	?	?	?	?	10.5

HARVESTING INTERPRETATIONS

Interpretations	Slope Class (%)					
	0-5	6-15	16-30	31-45	46-60	60 +
Harvesting Sensitivity	1	1	2	2	3	4
Trafficability	H	H	H	M	M	L
Road Suitability	H	H	H	M	M	L

Compaction Hazard : L

SILVICULTURAL INTERPRETATIONS

Species Suitability						Natural Regen-Potential	
bS	wS	L	P	bF	yB	Cut	L: bS
LD	LD	S	MD	LD	LD	Fire	M: bS

Topographic Position	Frost Heave Hazard	Windthrow Hazard
Uplands	L	L
Slopes	L	L
Valleys	L	L

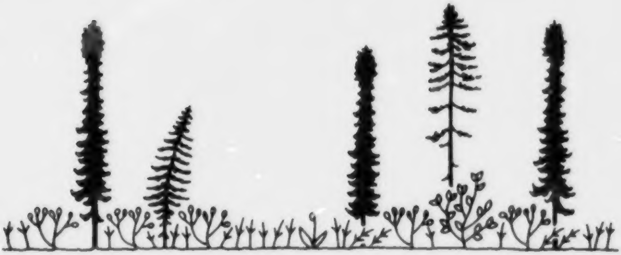
Comments :
Competition from *Kalmia angustifolia* (6) lowers the natural capability of this type. Planting without site preparation to eliminate *Kalmia* is not recommended.

Vegetation Competition Hazard (NSR Sites)

Region	Species							
	wB	tA	pC	mM	A	R	K	G-S
Western	L	X	L	X	X		H	X
Central	L	L	L	X	X	L	H	X
Northern	L	X	L	X	X	L	H	X
Eastern	L	X	L	X	X	L	H	X

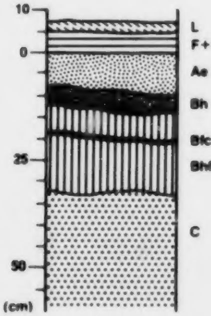
Cladonia-Kalmia-Black Spruce

SITE CONDITIONS

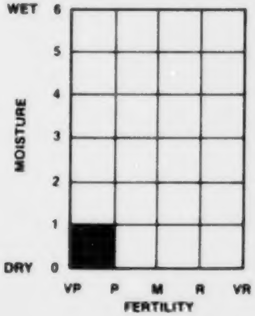


Site Conditions : Level outwash terrace; dry to extremely dry; sand and gravel; LFH 5-10 cm; roots 20-30 cm; pH 4.2-4.8

Soil Types : Orthic Humo-Ferric Podzol; Placic Humo-Ferric Podzol; Ortstein Humo-Ferric Podzol



SOIL PROFILE



EDAPHIC GRID

MANAGEMENT INTERPRETATIONS

SUCCESSION

Region	Disturbance			
	Cutting	Fire	Insects	NSR
Western	K #33	NC	NC	K #33
Central	K #33	NC	NC	K #33
Northern				
Eastern	K #33	NC	NC	K #33

PRODUCTIVITY

Region	CLI Class	CLI Subclass	Volume m³/ha	SI 50 (breast height) m			
				bF	bS	rP	EST
Western	7	MD	Non - merchantable			13.0	7.0
Central	7	MD	Non - merchantable			13.0	7.0
Northern							
Eastern	7	MD	Non - merchantable				7.0

HARVESTING INTERPRETATIONS

Interpretations	Slope Class (%)					
	0-5	6-15	16-30	31-45	46-60	60 +
Harvesting Sensitivity	1	1	1			
Trafficability	H	H	H			
Road Suitability	H	H	H			

Compaction Hazard : L

SILVICULTURAL INTERPRETATIONS

Species Suitability						Natural Regen-Potential	
bS	wS	L	P	bF	yB	Cut	L: bS
LD	LD	LD	MD	LD	LD	Fire	M: bS

Topographic Position	Frost Heave Hazard	Windthrow Hazard
Uplands	L	L
Slopes	L	L
Valleys	L	L

Comments :

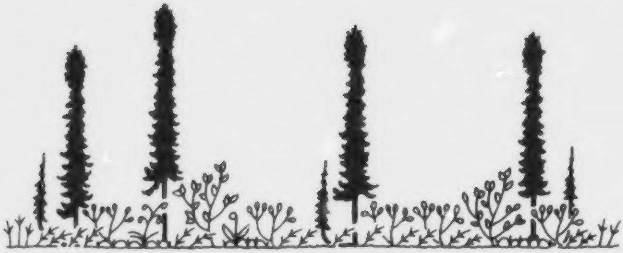
Marginally productive sites for Black Spruce or Balsam Fir, but may be merchantable with Red Pine or Jack Pine.

Vegetation Competition Hazard (NSR Sites)

Region	Species							
	wB	tA	pC	mM	A	R	K	G-S
Western	X	X	X	X	X	X	M	X
Central	X	X	X	X	X	X	M	X
Northern								
Eastern	X	X	X	X	X	X	M	X

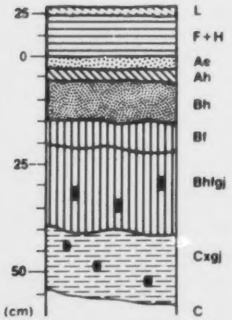
Nemopanthus-Kalmia-Black Spruce

SITE CONDITIONS

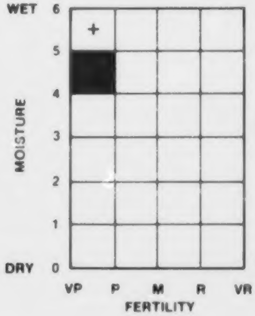


Site Conditions Transitional bog border forest; moist to somewhat wet; sandy loam to loam; LFH 20-40 cm; roots 30-40 cm; pH 4.3-4.6

Soil Types: Orthic Humic Podzol; Gleyed Ferro-Humic Podzol; Typic Folisol


25
0
25
50
(cm)
L
F+H
Ae
Ah
Bh
Bf
Bhfgj
Cxgj
C

SOIL PROFILE



EDAPHIC GRID

MANAGEMENT INTERPRETATIONS

SUCCESSION

Region	Disturbance			
	Cutting	Fire	Insects	NSR
Western	K #33	NC	NC	K #33
Central				
Northern				
Eastern	K #33	NC	NC	K #33

PRODUCTIVITY

Region	CLI Class	CLI Subclass	Volume m^3/ha	SI 50 (breast height) m			
				bF	bS	wS	EST
Western	7	FW		Non - merchantable			7.0
Central							
Northern							
Eastern	7	FW		Non - merchantable			7.0

HARVESTING INTERPRETATIONS

Interpretations	Slope Class (%)					
	0-5	6-15	16-30	31-45	46-60	60 +
Harvesting Sensitivity	2	2	3			
Trafficability	M	M	M			
Road Suitability	M	M	M			

Compaction Hazard : H

SILVICULTURAL INTERPRETATIONS

Species Suitability						Natural Regen-Potential	
bS	wS	L	P	bF	yB	Cut	L: bS layers
MD	LD	S	LD	LD	LD	Fire	M: bS

Topographic Position	Frost Heave Hazard	Windthrow Hazard
Uplands	M	H
Slopes	H	H
Valleys	H	M

Comments :

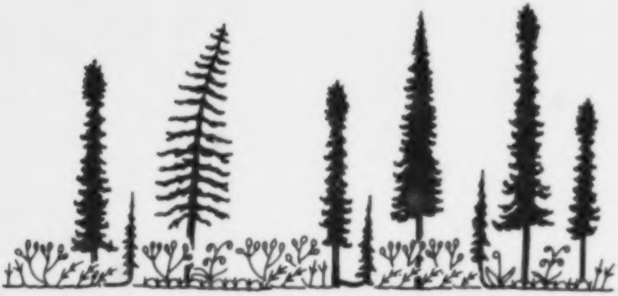
Marginally productive; wet, nutrient poor sites; severe limitations for harvesting and site preperation.

Vegetation Competition Hazard (NSR Sites)

Region	Species							
	wB	tA	pC	mM	A	R	K	G-S
Western	X	X	X	X	X	X	H	M
Central								
Northern								
Eastern	X	X	X	X	X	X	H	M

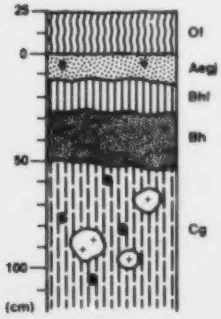
Sphagnum-Kalmia-Black Spruce

SITE CONDITIONS

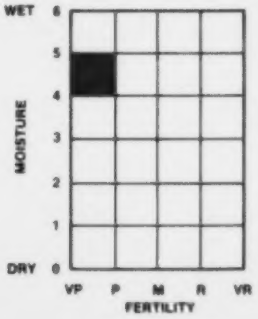


Site Conditions : Low slopes in transition to bogs; moist to somewhat wet; sandy loam to loamy sand; Of 20-40 cm; roots 20-30 cm; pH 4.2-4.4

Soil Types : Orthic Humic Podzol; Placic Humic Podzol; Fragic Humic Podzol



SOIL PROFILE



EDAPHIC GRID

MANAGEMENT INTERPRETATIONS

SUCCESSION

Region	Disturbance			
	Cutting	Fire	Insects	NSR
Western				
Central	NC	NC	NC	K #33
Northern	NC	NC	NC	K #33
Eastern				

PRODUCTIVITY

Region	CLI Class	CLI Subclass	Volume m³/ha	SI 50 (breast height) m			
				bF	bS	wS	EST
Western							
Central	6	WF	Non-merchantable				7.0
Northern	6	WF	Non-merchantable				7.0
Eastern							

HARVESTING INTERPRETATIONS

Interpretations	Slope Class (%)					
	0-5	6-15	16-30	31-45	46-60	60 +
Harvesting Sensitivity	2	2	3			
Trafficability	M	M	M			
Road Suitability	M	M	M			

Compaction Hazard : H

SILVICULTURAL INTERPRETATIONS

Species Suitability						Natural Regen-Potential	
bS	wS	L	P	bF	yB	Cut	L: bS layers
MD	LD	S	LD	LD	LD	Fire	M: bS

Topographic Position	Frost Heave Hazard	Windthrow Hazard
Uplands	M	H
Slopes	H	H
Valleys	H	M

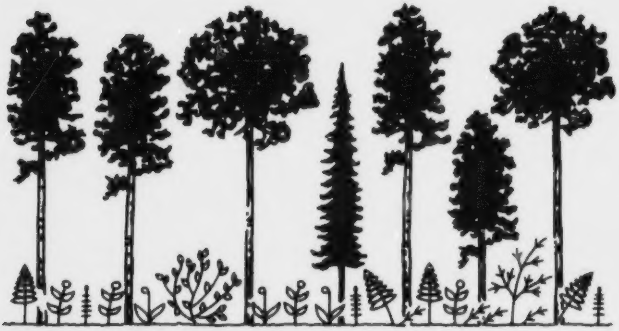
Comments :

Marginally productive; nutrient poor-wet sites; high limitations for harvesting and site preparation.

Vegetation Competition Hazard (HSR Sites)

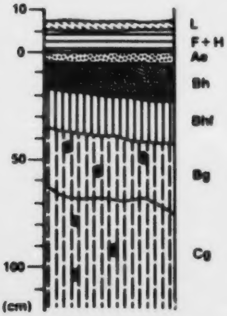
Region	Species							
	wB	tA	pC	mM	A	R	K	G-S
Western								
Central	X	X	X	X	X	X	H	M
Northern	X	X	X	X	X	X	H	M
Eastern								

SITE CONDITIONS

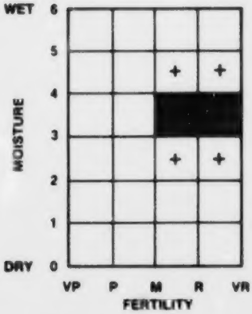


Site Conditions : Lower slopes and valleys; somewhat moist to moist; loam to silt loam; LFH 5-10 cm; roots 30-40 cm; pH 4.5-5.0

Soil Types : Orthic Humic Podzol; Gleyed Ferro-Humic Podzol; Gleyed Sombric Brunisol


10
0
50
100
(cm)
L
F + H
Ae
Bh
Bhf
Bg
Cg

SOIL PROFILE



EDAPHIC GRID

BtA #24

MANAGEMENT INTERPRETATIONS

SUCCESSION

Region	Disturbance			
	Cutting	Fire	Insects	NSR
Western				
Central	Fr #2	SM/D #17	X	Bt #32
Northern				
Eastern				

PRODUCTIVITY

Region	CLI Class	CLI Subclass	Volume m^3/ha	SI 50 (breast height) m			
				bF	bS	wS	EST
Western							
Central	4	F	?	?	?	?	13.0
Northern							
Eastern							

HARVESTING INTERPRETATIONS

Interpretations	Slope Class (%)					
	0-5	6-15	16-30	31-45	46-60	60 +
Harvesting Sensitivity	3	3	3	4	4	5
Trafficability	M	M	M	M	M	L
Road Suitability	M	M	M	M	M	L

Compaction Hazard : H

SILVICULTURAL INTERPRETATIONS

Species Suitability						Natural Regen-Potential	
bS	wS	L	P	bF	yB	Cut	L: bF, bS
S	MD	S	LD	MD	X	Fire	L: bS

Topographic Position	Frost Heave Hazard	Windthrow Hazard
Uplands	M	M
Slopes	M	M
Valleys	H	L

Comments :

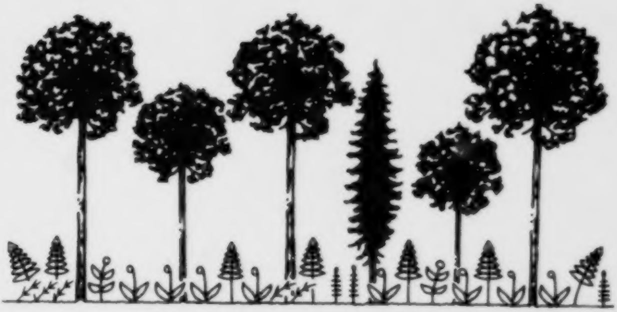
Originates after fire in central Nfld on the Fr (#2) and SM/M (#17) site types. Hardwood control essential for successful establishment of softwoods.

Vegetation Competition Hazard (NSR Sites)

Region	Species							
	wB	tA	pC	mM	A	R	K	G-S
Western								
Central	H	H	M	L	L	H	L	M
Northern								
Eastern								

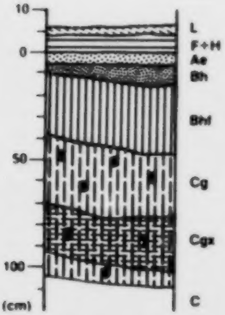
Dryopteris-Clintonia-Birch

SITE CONDITIONS

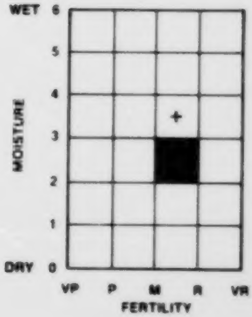


Site Conditions Mid to lower slopes; somewhat moist to moist; loam to silt loam; LFH 5-10 cm; roots 40-50 cm; pH 4.7-5.0

Soil Types Orthic Humic Podzol; Gleyed Ferro-Humic Podzol


10
0
50
100
(cm)
L
F+H
Ae
Bh
Bhf
Cg
Cgx
C

SOIL PROFILE



EDAPHIC GRID

MANAGEMENT INTERPRETATIONS

SUCCESSION

Region	Disturbance			
	Cutting	Fire	Insects	NSR
Western	Fdh #25	SM/M #17	X	Bl #32
Central				
Northern				
Eastern				

PRODUCTIVITY

Region	CLI Class	CLI Subclass	Volume m^3/ha	SI 50 (breast height) m			
				bF	bS	wS	EST
Western	3	M					13.0
Central							
Northern							
Eastern							

HARVESTING INTERPRETATIONS

Interpretations	Slope Class (%)					
	0-5	6-15	16-30	31-45	46-60	60 +
Harvesting Sensitivity	3	3	3	4	4	5
Trafficability	M	M	M	M	M	L
Road Suitability	L	L	L	L	L	L

Compaction Hazard : M

SILVICULTURAL INTERPRETATIONS

Species Suitability						Natural Regen-Potential	
bS	wS	L	P	bF	yB	Cut	L: bF
S	MD	S	LD	MD	MD	Fire	L: bS

Topographic Position	Frost Heave Hazard	Windthrow Hazard
Uplands	L	L
Slopes	L	L
Valleys	M	L

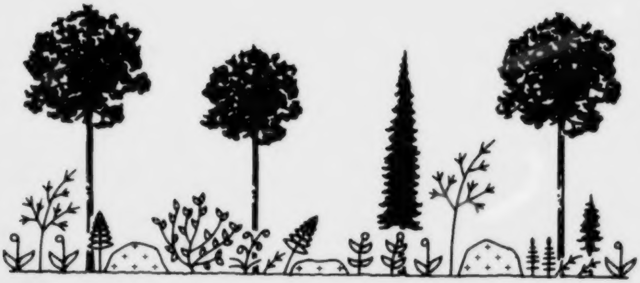
Comments :

Usually originates from Fdh (#5) type after fire in western Nfld. Competition control essential for softwood re-establishment.

Vegetation Competition Hazard (NSR Sites)

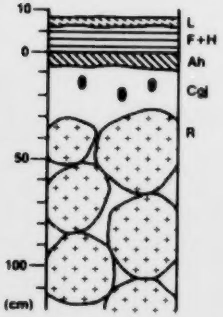
Region	Species							
	wB	tA	pC	mM	A	R	K	G-S
Western	H	L	M	M	L	M	X	L
Central								
Northern								
Eastern								

SITE CONDITIONS

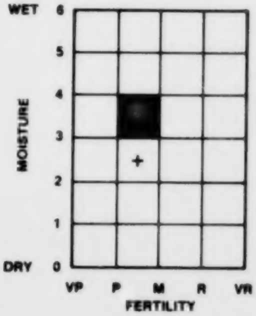


Site Conditions : Mid to lower slopes; somewhat moist to moist; colluvial material and scree; LFH 5-10 cm; roots 30-40 cm; pH variable

Soil Types : Orthic Regosol; Orthic Humic Regosol



SOIL PROFILE



EDAPHIC GRID

MANAGEMENT INTERPRETATIONS

SUCCESSION

Region	Disturbance			
	Cutting	Fire	Insects	NSR
Western	NC	NC	X	BI #32
Central	NC	NC	X	BI #32
Northern	NC	NC	X	BI #32
Eastern				

PRODUCTIVITY

Region	CLI Class	CLI Subclass	Volume m^3/ha	SI 50 (breast height) m			
				bF	bS	wS	EST
Western	7	E	Non-merchantable				
Central	7	E	Non-merchantable				
Northern	7	E	Non-merchantable				
Eastern							

HARVESTING INTERPRETATIONS

Interpretations	Slope Class (%)					
	0-5	6-15	16-30	31-45	46-60	60 +
Harvesting Sensitivity	1	1	2	2	2	2
Trafficability	M	M	M	L	L	L
Road Suitability	L	L	L	L	L	L

Compaction Hazard : L

SILVICULTURAL INTERPRETATIONS

Species Suitability						Natural Regen-Potential	
bS	wS	L	P	bF	yB	Cut	L: bF
S	MD	S	LD	MD	LD	Fire	L: bS

Topographic Position	Frost Heave Hazard	Windthrow Hazard
Uplands	L	M
Slopes	L	M
Valleys	L	M

Comments :

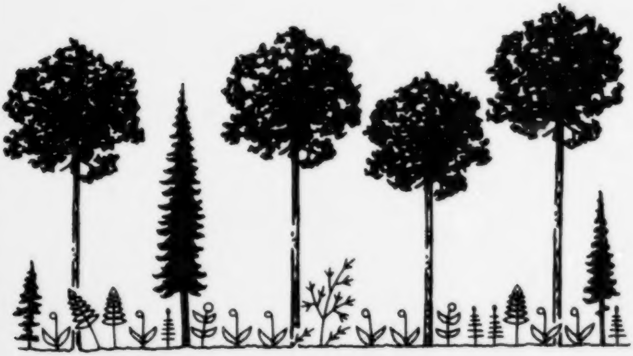
This site type occurs on steep talus slopes subject to periodic avalanche. Fire and cutting may stimulate soil movement. Planting on this forest type is not recommended.

Vegetation Competition Hazard (NSR Sites)

Region	Species							
	wB	tA	pC	mM	A	R	K	G-S
Western	H	X	L	M	M	M	X	L
Central	H	M	L	L	M	M	X	L
Northern	H	X	L	L	M	M	X	L
Eastern								

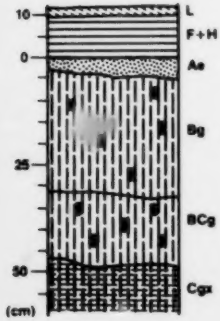
Rubus-Birch

SITE CONDITIONS

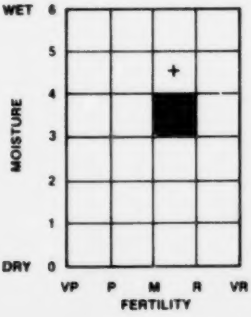


Site Conditions : Rocky slopes; somewhat moist to somewhat wet; seepage in rocky colluvium; LFH 10-15 cm; roots 30-40 cm; pH 4.7-5.0

Soil Types : Orthic Gleysol; Orthic Humic Gleysol; Gleyed Regosol



SOIL PROFILE



EDAPHIC GRID

MANAGEMENT INTERPRETATIONS

SUCCESSION

Region	Disturbance			
	Cutting	Fire	Insects	NSR
Western	Fr #2	SM/M #17	X	Mg #30
Central				
Northern				
Eastern				

PRODUCTIVITY

Region	CLI Class	CLI Subclass	Volume m^3/ha	SI 50 (breast height) m			
				bF	bS	wS	EST
Western	4	F	?	?	?	?	14.0
Central							
Northern							
Eastern							

HARVESTING INTERPRETATIONS

Interpretations	Slope Class (%)					
	0-5	6-15	16-30	31-45	46-60	60 +
Harvesting Sensitivity	3	3	3	4	4	5
Trafficability	M	M	M	M	M	L
Road Suitability	M	M	M	M	M	L

Compaction Hazard : H

SILVICULTURAL INTERPRETATIONS

Species Suitability						Natural Regen-Potential	
bS	wS	L	P	bF	yB	Cut	L: bF
S	MD	S	LD	MD	S	Fire	L: bS

Topographic Position	Frost Heave Hazard	Windthrow Hazard
Uplands	M	M
Slopes	M	M
Valleys	H	L

Comments :

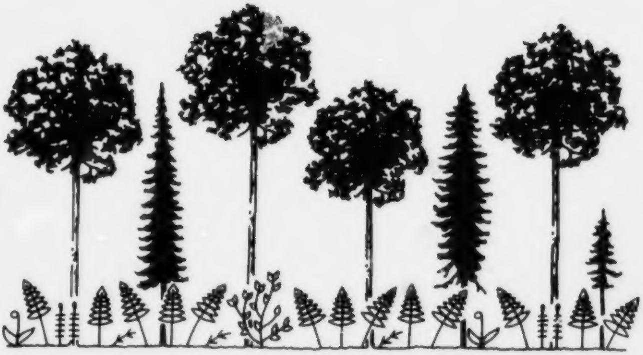
Usually originates from Fr (#2) or Fre (#1) site after fire. Competition control essential for the re-establishment of conifers.

Vegetation Competition Hazard (NSR Sites)

Region	Species							
	wB	tA	pC	mM	A	R	K	G-S
Western	H	X	M	H	M	H	X	M
Central								
Northern								
Eastern								

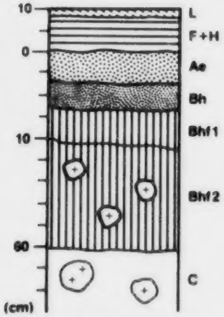
Dryopteris-Birch

SITE CONDITIONS

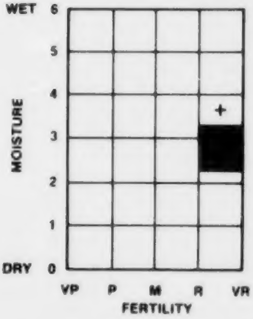


Site Conditions : Mid-slopes; somewhat moist; sandy loam to loam; LFH 5-10 cm; roots 40-50 cm; pH 4.3-4.8

Soil Types : Orthic Ferro-Humic Podzol; Orthic Humic Podzol; Fragic Ferro-Humic Podzol


10
0
10
60
(cm)
L
F+H
Ae
Bh
Bhf1
Bhf2
C

SOIL PROFILE



EDAPHIC GRID

MANAGEMENT INTERPRETATIONS

SUCCESSION

Region	Disturbance			
	Cutting	Fire	Insects	NSR
Western	Fd #6	SM/M #17	X	Bl #32
Central	Fd #6	SM/M #17	X	Bl #32
Northern	Fd #6	SM/M #17	X	Bl #32
Eastern	Fd #6	SM/M #17	X	Bl #32

PRODUCTIVITY

Region	CLI Class	CLI Subclass	Volume m^3/ha	SI 50 (breast height) m			
				bF	bS	wS	EST
Western	2-3	FC	?	?	?	?	15.2
Central	2-3	FC	?	?	?	?	13.0
Northern	3-4	F	?	?	?	?	10.0
Eastern	3-4	F	?	?	?	?	11.0

HARVESTING INTERPRETATIONS

Interpretations	Slope Class (%)					
	0-5	6-15	16-30	31-45	46-60	60 +
Harvesting Sensitivity	3	3	3	4	4	5
Trafficability	M	M	M	M	M	L
Road Suitability	L	L	L	L	L	L

Compaction Hazard : M

SILVICULTURAL INTERPRETATIONS

Species Suitability						Natural Regen-Potential	
bS	wS	L	P	bF	yB	Cut	L: bF, wS
S	MD	S	LD	MD	MD	Fire	L: bS

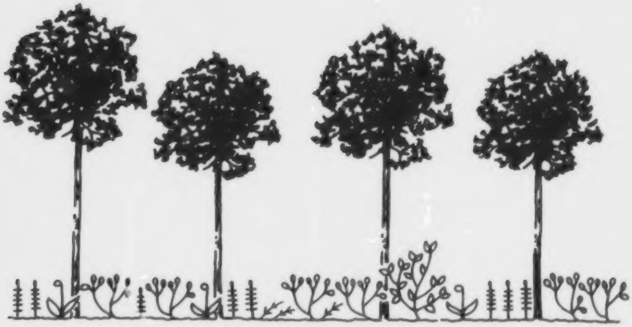
Topographic Position	Frost Heave Hazard	Windthrow Hazard
Uplands	L	M
Slopes	M	L
Valleys	M	L

Comments :
Originates from the Fd (#6) site following fire in the Western Newfoundland Ecoregion. Hardwood competition a serious problem for softwood growth.

Vegetation Competition Hazard (NSR Sites)

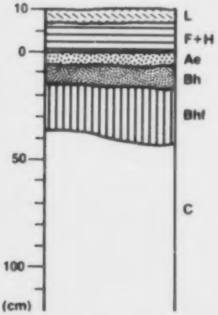
Region	Species							
	wB	tA	pC	mM	A	R	K	G-S
Western	H	L	M	M	L	H	L	M
Central	H	H	M	L	L	H	L	M
Northern	H	X	M	M	L	H	L	M
Eastern	H	L	M	L	L	H	L	M

SITE CONDITIONS

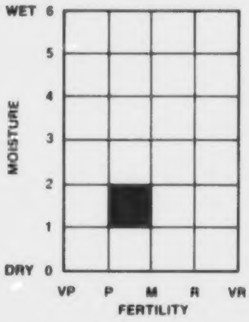


Site Conditions : Upper slopes and ridge summits; dry to well drained; loamy sand to sandy loam; LFH 10-15 cm; rooting 30-40 cm; pH 3.8-4.2

Soil Types : Orthic Ferro-Humic Podzol; Placic Ferro-Humic Podzol; Fragic Humic Podzol



SOIL PROFILE



EDAPHIC GRID

MANAGEMENT INTERPRETATIONS

SUCCESSION

Region	Disturbance			
	Cutting	Fire	Insects	NSR
Western	Fp #11	SK #20	X	K #33
Central	Fp #11	SK #20	X	K #33
Northern				
Eastern				

PRODUCTIVITY

Region	CLI Class	CLI Subclass	Volume m^3/ha	SI 50 (breast height) m			
				bF	bS	wB	EST
Western	5	MF	?	?	?	?	11.5
Central	5	MF	?	?	?	?	11.5
Northern							
Eastern							

HARVESTING INTERPRETATIONS

Interpretations	Slope Class (%)					
	0-5	6-15	16-30	31-45	46-60	60 +
Harvesting Sensitivity	1	1	2	2		
Trafficability	H	H	H	H		
Road Suitability	H	H	H	H		

Compaction Hazard : L

SILVICULTURAL INTERPRETATIONS

Species Suitability						Natural Regen-Potential	
bS	wS	L	P	bF	yB	Cut	L: bF
MD	LD	S	MD	LD	LD	Fire	L: bS

Topographic Position	Frost Heave Hazard	Windthrow Hazard
Uplands	L	L
Slopes	L	L
Valleys	L	L

Comments :

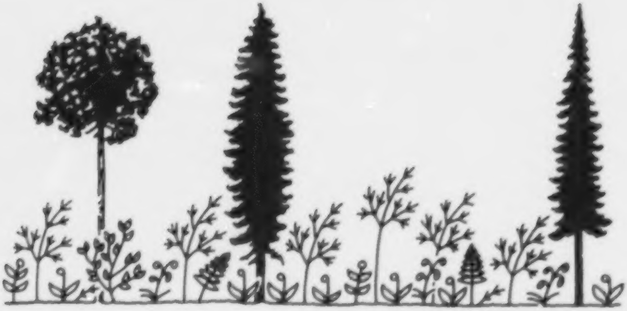
This type is very restricted in distribution primarily in the Central Newfoundland Ecoregion.

Vegetation Competition Hazard (NSR Sites)

Region	Species							
	wB	tA	pC	mM	A	R	K	G-S
Western	M	X	L	X	X	L	H	X
Central	M	M	L	X	X	L	H	X
Northern								
Eastern								

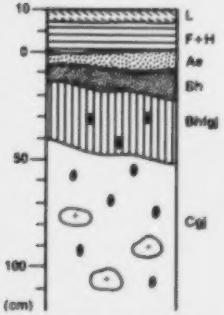
Galium-Mountain Maple

SITE CONDITIONS

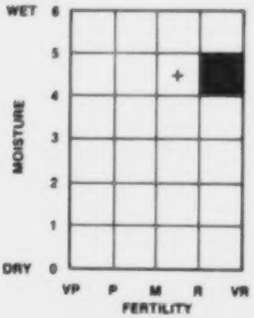


Site Conditions : Nutrient-rich seepage slopes; moist to somewhat wet; sandy loam to loam; LFH or muck horizon 10-20 cm; roots 40-60 cm; pH 5.0-6.0

Soil Types : Orthic Humic Podzol; Orthic Gleysol; Rego Gleysol



SOIL PROFILE



EDAPHIC GRID

MANAGEMENT INTERPRETATIONS

SUCCESSION

Region	Disturbance			
	Cutting	Fire	Insects	NSR
Western	Fre #1	Br #27	X	Mg #30
Central				
Northern	Fre #1	Br #27	X	Mg #30
Eastern				

PRODUCTIVITY

Region	CLI Class	CLI Subclass	Volume m^3/ha	SI 50 (breast height) m			
				bF	bS	wS	EST
Western	4	W	?	?	?	?	13.0
Central							
Northern	4	W	?	?	?	?	11.5
Eastern							

HARVESTING INTERPRETATIONS

Interpretations	Slope Class (%)					
	0-5	6-15	16-30	31-45	46-60	60 +
Harvesting Sensitivity	3	3	3	4	4	5
Trafficability	M	M	L	L	L	L
Road Suitability	M	M	L	L	L	L

Compaction Hazard : H

SILVICULTURAL INTERPRETATIONS

Species Suitability						Natural Regen-Potential	
bS	wS	L	P	bF	yB	Cut	L: bF, wS
S	MD	MD	LD	S	LD	Fire	L: bS

Topographic Position	Frost Heave Hazard	Windthrow Hazard
Uplands	M	H
Slopes	H	H
Valleys	H	M

Comments :

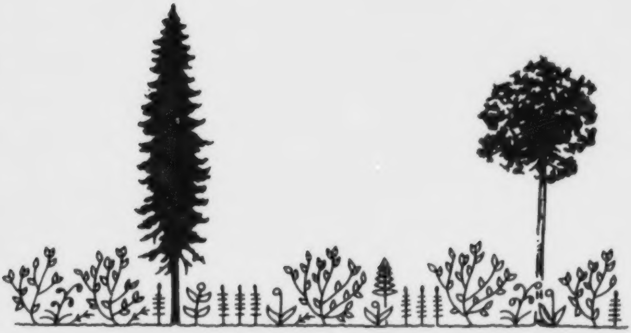
Highly productive sites originating from Fre (#1), Fr (#2) and Fd (#6) after fire in the Western Newfoundland Ecoregion. Vegetation management essential for softwood establishment on NSR sites.

Vegetation Competition Hazard (NSR Sites)

Region	Species							
	wB	tA	pC	mM	A	R	K	G-S
Western	H	L	L	H	H	H	L	H
Central								
Northern	H	X	L	H	H	H	L	H
Eastern								

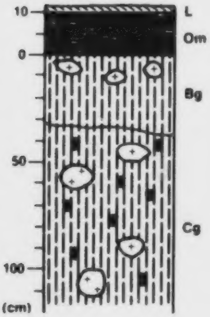
Lycopodium-Alder Swamp

SITE CONDITIONS

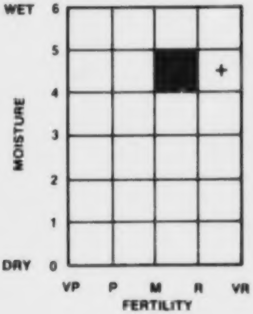


Site Conditions : Slightly depressed areas on seepage slopes or flats; somewhat wet to wet; sandy loam to clay loam; muck 10-20 cm; roots 30-40 cm; pH 4.8-5.0

Soil Types : Orthic Gleysol; Rego Gleysol; Orthic Humic Gleysol



SOIL PROFILE



EDAPHIC GRID

MANAGEMENT INTERPRETATIONS

SUCCESSION

Region	Disturbance			
	Cutting	Fire	Insects	NSR
Western				
Central	Fdl #8	BtA #24	X	AL #31
Northern				
Eastern				

PRODUCTIVITY

Region	CLI Class	CLI Subclass	Volume m^3/ha	SI 50 (breast height) m			
				bF	bS	tL	EST
Western							
Central	3	W	?	?	?	14.0	13.0
Northern							
Eastern							

HARVESTING INTERPRETATIONS

Interpretations	Slope Class (%)					
	0-5	6-15	16-30	31-45	46-60	60 +
Harvesting Sensitivity	3	3	3	4	4	5
Trafficability	M	M	L	L	L	L
Road Suitability	L	L	L	L	L	L

Compaction Hazard H

SILVICULTURAL INTERPRETATIONS

Species Suitability						Natural Regen-Potential	
bS	wS	L	P	bF	yB	Cut	L: bF, bS
MD	S	MD	LD	S	LD	Fire	L: bS

Topographic Position	Frost Heave Hazard	Windthrow Hazard
Uplands	M	H
Slopes	L	H
Valleys	L	H

Comments:

Very productive, highly sensitive sites in the Central Newfoundland Ecoregion. Vegetation management essential for successful softwood establishment and growth on NSR sites.

Vegetation Competition Hazard (NSR Sites)

Region	Species							
	wB	tA	pC	mM	A	R	K	G-S
Western								
Central	M	H	L	M	H	L	X	H
Northern								
Eastern								

SITE CONDITIONS

Birch Thickets are tall shrub (2-5 m) vegetation that develop on a wide variety of soil nutrient and moisture conditions after removal of the coniferous forest canopy. The thicket seral stage reaches its optimal development on most sites between 6 and 10 years after disturbance. Raspberry, herbs or low shrubs are prominent before 6 years and coniferous crown closure should gradually eliminate the hardwood thickets after 16 years.

Based upon preliminary research, 5 tentative Birch Thicket vegetation subtypes can be recognized. The relationship of these subtypes to soil moisture and nutrients is summarized in the accompanying edaphic grid. The following is a brief description of the 5 thicket subtypes that commonly occur on cut overs:

1. **Equisetum-Rubus-Birch**

Open White Birch, Yellow Birch and Mountain Maple thickets with a very well developed herbaceous understory similar to the Fre (#1) mature forest type. (Table 11). Usually under to marginally stocked coniferous regeneration.

2. **Rubus-Birch**

Usually dense hardwood thickets dominated by White Birch with lesser amounts of Mountain Ash, Yellow Birch and *Viburnum edule* (21). Replaces Fr (#2) after disturbance and has the same differential species as outlined in Table 11.

3. **Dryopteris-Birch**

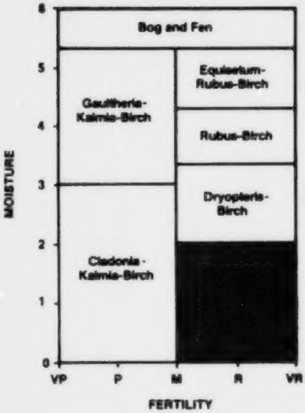
Dense thickets dominated by White Birch with patches of *Dryopteris spinulosa* (29,30,31) and a variety of forest herbs conspicuous in the understory. This subtype occupies a wide range of medium fertility site conditions. In determining the appropriate mature forest type in these sites one should use the moisture regime, soil texture and soil reaction as key diagnostic criteria as shown in Table 12 and Table 14.

4. Gaultheria-Kalmia-Birch

Usually open White Birch thickets on moist to wet sites with dwarf shrubs common in the understory. Occurs as a marginally stocked seral stage following disturbance of the Fg (#10) or SM/B (#16) forest types. *Gaultheria hispidula* (24), *Epigaea repens* (23), *Coptis groenlandica* (50) and *Kalmia angustifolia* (6) are common to abundant.

5. Cladonia-Kalmia-Birch

Usually open White Birch thickets on dry to somewhat moist sites with dwarf shrubs and *Cladonia* (92-95) common. Open Coniferous regeneration marginal to adequate representing seral stages following disturbance of the Fp (#11) or SM/D (#15) forest types. Understocked sites would be classfied as Kalmia Heath (#33).



EDAPHIC GRID

MANAGEMENT INTERPRETATIONS

There are two conditions under which seral Birch Thickets may fail to develop:

1. Sites with less than 2400 softwood stems per hectare which may develop into mature hardwood forest types or heath.
2. Sites with an excess of 10,000 stems per hectare which may develop to dense softwood thicket to the total exclusion of Birch Thicket seral stages. The latter succession is most common on moist, fertile sites with feathermoss dominant in the understory, i.e.; Fh (#9), Fdh (#5) and SM/M (#17).

SITE CONDITIONS

Heaths dominated by *Kalmia angustifolia* (6) are one of the most significant concerns to forest management because they develop on productive forest lands, particularly in the Central Newfoundland, North Shore and Maritime Barrens Ecoregions (see Chapter 6). Sites dominated by Kalmia Heath are usually poorly stocked to conifers and display very slow rates of height and diameter growth. These conditions appear to be less pronounced in pines and Eastern Larch and most pronounced in Black Spruce, White Spruce and Balsam Fir. Plantations in Kalmia Heath vegetation to date have been generally disappointing.

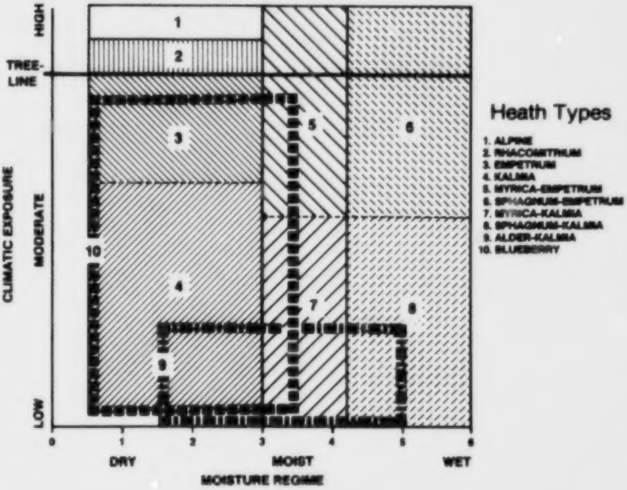
In the open heath landscape, climatic exposure, particularly as it related to winter snow depths, is an important determinant of vegetation composition and structure. Soil fertility tends to be masked by the deep organic layer (duff) characteristic of most heath types. The accompanying diagram illustrates the relationship of 10 common heathland types to gradients in moisture and climatic exposure.

The Alpine and Rhacomitrium heath types are the only climatic types that have never supported a forest cover. The Alpine heaths are most common in the Long Range Barrens (Ecoregion VIII), while the Rhacomitrium heaths are characteristic of the Hyper-Oceanic Barrens (Ecoregion VII). These types were mapped as "rock barrens" in the CLI inventory (Delaney 1974).

Empetrum heath types are low, lawn-like shrub barrens which can occur in the alpine zone or on the most exposed ridges and coastal headlands below treeline. The Myrica-Empetrum and Sphagnum-Empetrum types occupy moist and wet site variations, respectively. Although these areas were once forested, it appears that current conditions for tree growth require some form of shelterbelt management for successful reforestation.

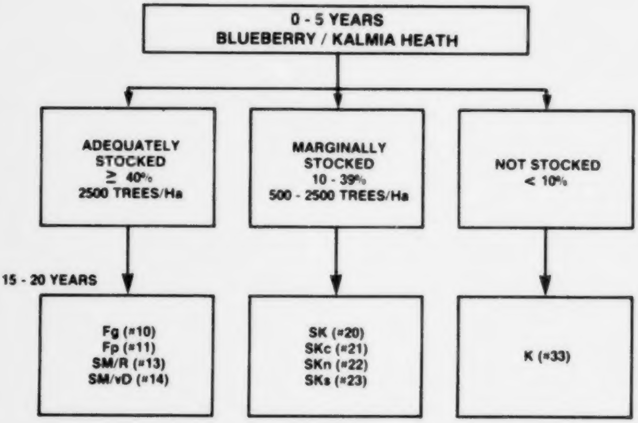
The Kalmia heaths are usually knee-high shrub thickets that reach optimum development in sheltered lowlands associated with deep snow cover. The Myrica-Kalmia and Sphagnum-Kalmia types occupy moist and wet sites, respectively. The Alder-Kalmia type is dominated by *Alnus crispa* (3) on a wide range of moisture conditions but in decidedly sheltered habitats. Alders can spread rapidly when the humus layer is destroyed by fire or scarification.

Blueberry heaths can temporarily replace most other heath types in the 2-5 year period after wildfire or prescribed burning. A more in-depth description of heath types can be found in Meades (1983).


HIGH
TREE-LINE
MODERATE
LOW
CLIMATIC EXPOSURE
1
2
3
4
5
6
7
8
9
10
0
1
2
3
4
5
6
DRY
MOIST
WET
MOISTURE REGIME
Heath Types
1. ALPINE
2. RHACOMITRIUM
3. EMPETRUM
4. KALMIA
5. MYRICA-EMPETRUM
6. SPHAGNUM-EMPETRUM
7. MYRICA-KALMIA
8. SPHAGNUM-KALMIA
9. ALDER-KALMIA
10. BLUEBERRY

MANAGEMENT INTERPRETATIONS

Assessment of "Kalmia sites" requires particular attention to the relationship between site, age, conifer stocking and cover of *Kalmia angustifolia* (6). Nearly all dry nutrient-poor cutovers have some *Kalmia* frequently interspersed with blueberry, *Vaccinium angustifolium* (18). The blueberry does not appear to adversely affect conifer regeneration. A clearcut or burn with adequate conifer stocking (2500 stems/ha), 20-40% *Kalmia* cover and 5-10 years of age should be able to attain crown closure at about 20-25 years. However, the same site with inadequate stocking or average spacing of less than 2.0 m is probably destined to become a Kalmia-Black Spruce (#20) or Kalmia Heath (#33) since the rate of crown closure is less than the rate of shrub expansion. Also, such sites will not respond well to reforestation since seedling growth will not keep pace with increases in shrub density. Prescriptions for such sites are currently being researched by Forestry Canada and the Newfoundland Department of Forestry and Agriculture in a cooperative field experiment.


0 - 5 YEARS
BLUEBERRY / KALMIA HEATH
ADEQUATELY STOCKED
≥ 40%
2500 TREES/Ha
MARGINALLY STOCKED
10 - 39%
500 - 2500 TREES/Ha
NOT STOCKED
< 10%
15 - 20 YEARS
Fg (#10)
Fp (#11)
SM/R (#13)
SM/vD (#14)
SK (#20)
SKc (#21)
SKn (#22)
SKs (#23)
K (#33)

CHAPTER 5

SOIL CHARACTERISTICS

This chapter is intended to help the user recognize those soil features used in the diagnostic keys and fact sheet descriptions, i.e. soil taxonomy, soil texture, soil moisture and soil fertility. Only the most commonly encountered soil groups are described in this chapter and for a more comprehensive treatment the user is referred to The System of Soil Classification For Canada (CSS Committee, 1978) and local soil series descriptions and maps provided by the Newfoundland Department of Agriculture (Figure 6). Also, soil fertility is a very complex topic and it is only presented to show how the forest types have been assigned to the edaphic grid in the fact sheets. More thorough discussions can be found in Brady (1974) and Kimmins (1987).

SOIL TAXONOMY

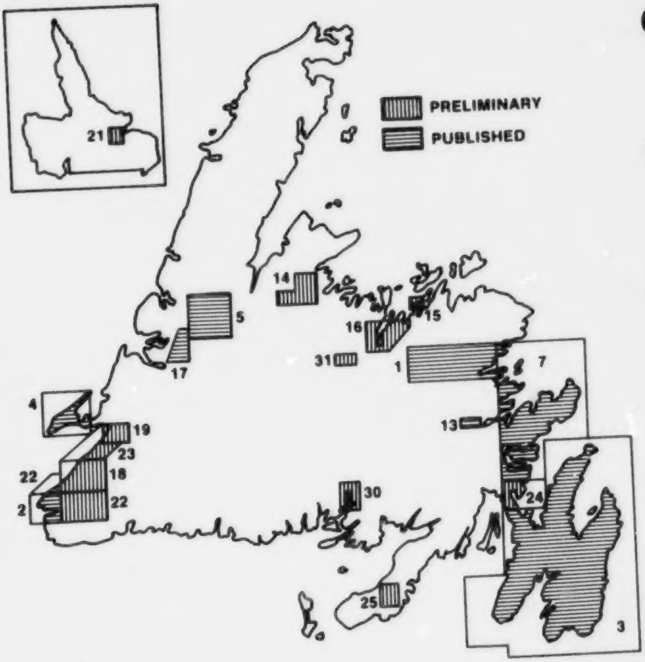
Podzolic, Gleysolic, Regosolic and Organic are the most common soil orders in Newfoundland. Podzols are considered the zonal soils for this region because they occur on moderate sites (i.e. no extremes of texture or wetness). Gleysols and Organic soils are usually associated with excessive moisture. Regosols lack profile differentiation either because of frequent disturbance (i.e. alluvial or colluvial material) or inert materials. A brief description of the criteria used to separate representative orders, great groups and subgroups follows.

Podzols

Podzols usually have an **LFH** humus layer over a light colored **Ae** (eluvial) surface horizon which is sometimes absent. The podzolic **B** horizon is reddish brown to black at the surface and grades to yellowish near transition to the **C** horizon. Podzols are divided into three great groups on the organic matter and iron content.

Humic Podzol (Bh)

Humic podzols are characterized by a high ratio of organic matter to iron resulting in a dark brown to almost black podzolic **Bh** horizon (Munsell Chroma 1-2) greater than 10cm thick. This type is usually associated with wet sites often transitional to organic soils, however in humid climates it can occur under heath vegetation on relatively well drained sites.


PRELIMINARY
PUBLISHED
21
14
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1
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2
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25
3

SOIL SURVEY AREA MAPS

1. Gander-Gambo
2. Codroy
3. Avalon
4. Port au Port
5. Cormack-Deer Lake
7. Bonavista
13. Terra Nova
14. Green Bay
15. Comfort Cove
16. Bay of Exploits
17. Pasadena-Deer Lake
18. St. Fintan's
19. Flat Bay
21. Goose Bay
22. Grandys Lake-Friars Cove
23. Flat Bay-Main Gut
24. Sunnyside
25. Winterland
30. Bay d'Espoir
31. Wooddale

Figure 6. Areas of Newfoundland covered by soil series maps.

Ferro-Humic Podzol (Bhf)

These soils are characterized by a podzolic **Bhf** horizon at least 10cm having a high organic matter content and appreciable Fe and Al that produces a reddish brown color. This soil great group is probably the most common soil associated with moist coniferous forest and heath vegetation in this region.

Humo-Ferric Podzols (Bf)

These soils are characterized by a podzolic **Bf** horizon at least 10cm having a relatively higher iron content and less organic matter than the above great groups. Typically, the podzolic horizon is more reddish and lighter in color than the **Bh** and **Bhf** horizons. In Newfoundland these soils are most frequently encountered on well-drained, coarse texture sites often with ortstein development

Gleysols

Soils of this order are most frequently encountered in lowlands and depressions where there is prolonged water stagnation causing anerobic conditions. Gleysolic soils usually have a gleyed horizon (**Bg** or **Cg**) within 50cm of the surface characterized by bluish gray colors, promient mottling or both. The blue-gray colors are caused by the anerobic reduction of the yellowish red ferric oxide Fe_2O_3 - typical of the well drained podzolic horizon) to ferrous oxide (Fe0).

Humic Gleysol

This great group has a dark brown to black surface horizon enriched with organic matter **(Ah)** to a depth of at least 10cm. Soils with a distinct **Bh** horizon are termed Orthic Humic Gleysols, those with only a **Cg** horizon are referred to as rego humic gleysols.

Gleysol

This great group lacks the diagnostic **Ah** horizon to a depth of 10cm. Orthic gleysols have a **Bg** horizon while rego gleysols lack a **Bg** horizon and have only a **Cg** horizon.

Luvic Gleysol

This great group is characterized by a horizon of clay accumulation **(Bt).** These soils are seldom encountered on productive forest sites in this region.

Regosol

Soils of this order lack distinct profile development. In this region these soils are most commonly encountered on floodplains, colluvium and scree slopes. Soils with an **Ah** horizon greater than 10cm are classified as Humic Regosols, all others fall in the Orthic Regosol great group.

Organic

This order includes soils composed **primarily** of organic matter commonly referred to as peat, muck or bog soils. In Newfoundland merchantable forests rarely grow on peats exceeding 1.0m in depth and, therefore, most of the organic soils referred to in this manual fall within the terric subgroups. The organic soils have four great groups. The description here is somewhat oversimplified and for a more critical description the user should follow C.S.S.C. (1978).

Fibrisol

The surface horizon up to 120cm is dominated by organic material that is only partially decomposed **(fibric)** with a von Post decomposition of 1-4 (Table 19).

Mesisol

The surface organic horizon up to 120cm is dominated by moderately decomposed material (mesic) with a von Post decomposition 5-6.

Humisol

The surface organic horizon up to 120cm is dominated by well decomposed muck (humic) with a von Post decomposition of 7 and greater.

Folisol

The surface consists of an **LFH** horizon at least 10cm thick over bedrock or fragmental material. A layer of till 10cm or less may occur between the **LFH** and lithic contact. The typic folisol is the only subgroup currently recognized. These soils are commonly associated with Black Spruce-Feathermoss forests on shallow soils.

The soil orders and great groups are further divided into subgroups based on the presence or absence of profile modifications caused by moisture, compaction and various impervious horizons. The following is a short description of some of the most common diagnostic horizons in this region. Symbols in brackets give the abbreviations used in the soil profile sketches in each fact sheet.

Orthic - refers to a profile that is generally typical for a particular great group, i.e. Orthic Ferro-Humic Podzol or Orthic Humic Gleysol.

Fragic (x) - refers to a profile with a fragipan consisting of loamy subsurface material with high bulk density and low organic matter that appears to be cemented. Fragipans have considerable ecological significance because they often pro-

Table 19. Peat decomposition scale (L. von Post 1924).

Fibric (Of)	H_1 - Completely undecomposed peat; only clear water squeezed out.
	H_2 - Almost undecomposed and mud-free peat; water that is squeezed out is almost clear and colorless.
	H_3 - Very little decomposed and very slightly muddy peat; when squeezed, water is obviously muddy but no peat passes through fingers. Residue retains structure of peat.
	H_4 - Poorly decomposed and somewhat muddy peat; when squeezed water is muddy. Residue muddy but it clearly shows growth structure of peat.
Mesic (Om)	H_5 - Somewhat decomposed, rather muddy peat; growth structure visible but somewhat indistinct; when squeezed some peat passes through fingers but mostly very muddy water. Press residue muddy.
	H_6 - Somewhat decomposed, rather muddy peat; growth structure indistinct; less than ⅓ of peat passes through fingers when squeezed. Residue very muddy, but growth structure more obvious than in unpressed peat.
Humic (Oh)	H_7 - Rather well-decomposed, very muddy peat; growth structure visible, about ½ of peat squeezed through fingers. If water is squeezed out, it is porridge-like.
	H_8 - Well-decomposed peat; growth structure very indistinct; about ⅔ of peat passes through fingers when pressed, and sometimes a somewhat porridge-like liquid. Residue consists mainly of roots and resistant fibers.
	H_9 - Almost completely decomposed and mud-like peat; almost no growth structure visible. Almost all peat passes through fingers as a homogeneous porridge if pressed.
	H_{10} - Completely decomposed and muddy peat; no growth structure visible; entire peat mass can be squeezed through fingers.

mote lateral water seepage on slopes and increase forest growth.

Placic (c) - a thin dark reddish brown layer (less than 5cm thick) cemented by complexes of iron, aluminum or iron manganese.

Duric (c) - a strongly cemented horizon at a depth of 40-80cm whose color does not differ appreciably from parent material which is usually coarse textured.

Ortstein (c) - strongly cemented reddish brown to dark reddish brown Bh, Bhf or Bf horizon at least 3 cm thick that occupies more than one-third the profile face.

Lithic (R) - consolidated bedrock below a depth of 10 cm.

Conventions Used in Soil Profile Descriptions

The following legend (Table 20) explains the symbols used in describing typical soil profiles for the forest types included in fact sheets 1-33. The selected profile is used primarily to express the general "theme" of the site and the user should realize that a variety of soil subgroups can occupy any forest type. Soil taxonomy reflects primarily the features and processes controlling soil development. These features and processes are often different and act on time scales quite

Table 20. Abbreviations used in the soil profile descriptions.

L,F,H	organic horizons, developed mainly from leaves, needles and twigs (litter layer).
Ah	dark-colored, mineral, surface horizons, enriched with organic matter.
Ae	light-colored near surface horizon. Horizon leached of iron, aluminum, organic matter or clay.
AB	a transition horizon from A to B.
Bf, Bhf	reddish-brown subsurface horizon with significant accumulation of iron, aluminum and/or organic matter.
Bg, Cg	gleyed horizons due to high water table, gray in color often with mottling.
Bk, Ck	horizons containing calcium and/or magnesium carbonates that will effervesce with dilute HCL.

Bh	this horizon contains more than 1% organic C, less than 0.3% pyrophosphate-extractable Fe, and has a ratio of organic C to pyrophosphate-extractable Fe of 20 or more. Generally a dark brown surface horizon enriched with organic matter.
BC	a transition horizon from B to C.
C	relatively unweathered material from which the soil profile has developed.
c	a cemented pedogenic horizon (i.e. iron pan or placic horizon
gj	a juvenile gleyed horizon characterized by mottling but not necessarily gray in color.
j	juvenile, used as a modifier to denote an undeveloped condition.
mottling	spots or blotches of different color or shade interspersed with the dominant soil color.
Of,Om,Oh	organic horizons developed mainly from mosses and sedges. Poor drainage conditions. The state of decomposition is denoted by f - fibric, poorly decomposed; m - mesic, moderately decomposed; h - humic, well decomposed.
R	this is a consolidated bedrock layer that is too hard to break with the hands or dig with a spade when moist and does not meet the requirements of a C Horizon. The boundary between the R layer and any overlying unconsolidated material is called a lithic contact.
x	a horizon of fragipan character. A fragipan is a loamy subsurface horizon of high bulk density and very low organic matter content. When dry, it has a hard consistence and seems to be cemented. When moist, it has moderate to weak brittleness. It frequently has bleached fracture planes and is overlain by a friable B horizon. Air-dry clods of fragic horizons slake in water.

different from those controlling forest compostion and growth.

Soil Moisture Regime

Soil drainage is based on soil morphology only. Moisture regime is based on the amount of water available to plants. It is evaluated on the basis of soil drainage, soil structure, texture and regional climate. Thus a well-drained till is much moister than a well-drained coarse textured glacio-fluvial deposit. Similarly a well-drained sandy loam in a humid climate is moister than the same soil texture in a dryer region.

Table 21 summarizes the criteria used to determine soil moisture regime for the purpose of this forest classification.

Soil Texture

The triangle in figure 7 is used to define soil texture on the basis of laboratory analysis of soil particle classes in the less than 20mm fraction of a soil sample. The texture field tests are used in combination with the adjacent table to estimate soil texture from fresh soil samples in the field (Figure 8). The latter approach once mastered is quite adequate for recconnaissance level land surveys and forest site assessment.

Soil Fertility

The edaphic grid on each fact sheet illustrates the position of each forest type with respect to soil moisture regime and relative fertility. The moisture regime is determined using soil moisture regime scale outlined in Table 21. The assessment of soil fertility is somewhat more complex. Soil fertility is considered to be the status of a soil with respect to its ability to supply the nutrients essential for plant growth. However, there are many nutrients essential to plant growth that might be limiting and their availability is controlled by a complex of physical, biological and chemical factors acting in synchrony. Consequently, soil fertility cannot be quantified using any single analytical measurement of the vegetation or soil.

Traditionally, ecologists have used vegetation as an indicator of site fertility. Species of trees, shrubs, herbs and mosses occur in species groups that consistently occur together (sociological species groups). By careful observation of how such species groups react to changes in climate, relief and soil properties throughout a region, it is possible to differentiate which species can be used to assess relative site fertility often indicated as oligotrophic (poor), mesotrophic (medium) and eutrophic (rich) nutrient regimes. It is primarily this approach in combination with the presence or absence of seepage waters, humus content and texture of the soil that is used to determine the position of a forest type with respect to the edaphic

Table 21. Soil moisture regime scale (after Damman 1964).

$\overline{0}$ - **Extremely dry:** steep eroding sands, rock piles, gravel.

0 - **Very dry:** medium and coarse sands: shallow soils, not influenced by ground water.

1 - **Dry:** deep silty sands and loamy sands, not influenced by ground water.

2 - **Well-drained:** deep sandy loams and loams, not influenced by ground water.

3 - **Somewhat moist:** loams and sandy loams with some rust mottling in lower part of B or C horizon. Moist variants of zonal soil types.

4 - **Moist:** soil surface above the maximum water level; normal soil profile development hampered because of imperfect drainage. Upper 1-2 feet of soil well-aerated during vegetative season. On mineral soils a severely mottled to homogeneous brown horizon (color B) is present. Occurs also on heavy textured soils with perched water table and on dry deep peat.

5 - **Somewhat wet:** maximum water level at or close to the soil surface. Anaerobic soils; on mineral soils reduced, grey soil matrix with rust mottling. Gleysols, some peat soils.

6 - **Wet:** water level at soil surface for most of vegetative season. Reduced gley layer up to mineral soil surface on mineral soils; mottling usually absent or insignificant. Organic soil , gleysol.

7 - **Very wet:** water level above soil surface for most part of vegetative season. Minimum water level approximately at soil surface. Organic soil.

8 - **Permanently inundated:** minimum water level above soil surface, soils permanently inundated. Sapropel, dry, gyttja, and marl soils.

Seepage moisture regimes are underlined (for instance $\underline{4}$), whereas the moisture regimes of deep organic soils have a bar over the moisture regime figures (for instance $\overline{5}$).

TEXTURE FIELD TESTS

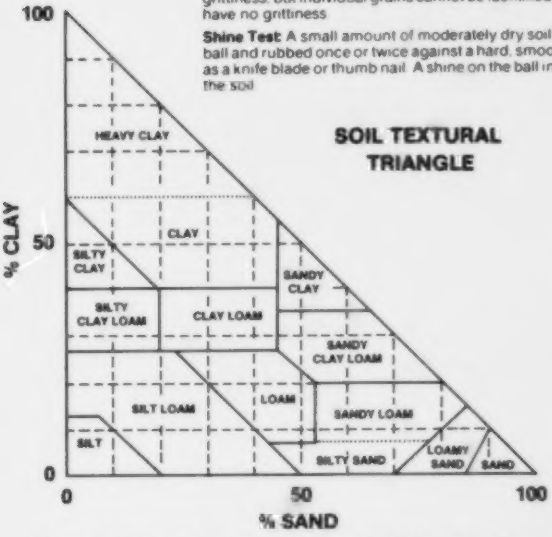
Moist cast test: Compress some moist soil by clenching it in you hand. If the soil holds together (i.e., forms a cast) then test th strength of the cast by tossing it from hand to hand. The more durable it is, the more clay is present.

Ribbon Test: Moist soil is rolled into a cigarette shape and then squeezed out between the thumb and forefinger to form the longest and thinnest ribbon possible.

Feel Test:
GRAININESS TEST - Soil is rubbed between thumb and finge to assess the % of sand. Sand feels grainy.
DRY FEEL TEST - Soils with >50% sand. Soil is rubbed in the palm of the hand to dry it and to separate and estimate the size of the individual sand particles. The sand particles are then allowed to fall out of the hand and the amount of finer material (silt and clay) remaining is noted.
STICKINESS TEST - Soil is wetted and compressed between the thumb and forefinger. Degree of stickiness is determined b noting how strongly it adheres to the thumb and forefinger up release of pressure and how much it stretches.

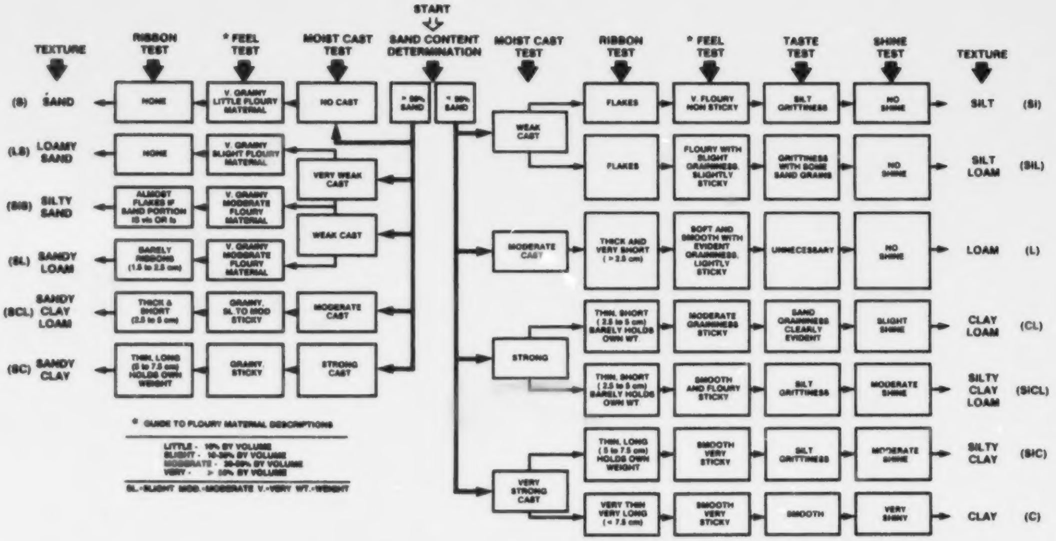
Taste Test: A small amount of soil is worked between the front teeth. Sand is distinguished as individual grains which grit sharply against the teeth. Silt particles are identified as a general fine grittiness, but individual grains cannot be identified. Clay particles have no grittiness.

Shine Test: A small amount of moderately dry soil is rolled into a ball and rubbed once or twice against a hard, smooth object such as a knife blade or thumb nail. A shine on the ball indicates clay in the soil.



SOIL TEXTURAL TRIANGLE

Figure 7. Soil texture groupings and field methods used to determine soil texture (after Jones *et al* 1983).



START
SAND CONTENT DETERMINATION
> 50% SAND
< 50% SAND
TEXTURE
RIBBON TEST
* FEEL TEST
MOIST CAST TEST
TASTE TEST
SHINE TEST
(S) SAND
(LS) LOAMY SAND
(SiS) SILTY SAND
(SL) SANDY LOAM
(SCL) SANDY CLAY LOAM
(SC) SANDY CLAY
NONE
NONE
ALMOST FLAKES IF SAND PORTION IS vfs OR fs
BARELY RIBBONS (1.5 to 2.5 cm)
THICK & SHORT (2.5 to 5 cm)
THIN, LONG (5 to 7.5 cm) HOLDS OWN WEIGHT
V. GRAINY LITTLE FLOURY MATERIAL
V. GRAINY SLIGHT FLOURY MATERIAL
V. GRAINY MODERATE FLOURY MATERIAL
V. GRAINY MODERATE FLOURY MATERIAL
GRAINY, SL. TO MOD STICKY
GRAINY, STICKY
NO CAST
VERY WEAK CAST
WEAK CAST
MODERATE CAST
STRONG CAST
WEAK CAST
MODERATE CAST
STRONG
VERY STRONG CAST
FLAKES
FLAKES
THICK AND VERY SHORT (> 2.5 cm)
THIN, SHORT (2.5 to 5 cm) BARELY HOLDS OWN WT.
THIN, SHORT (2.5 to 5 cm) BARELY HOLDS OWN WT
THIN, LONG (5 to 7.5 cm) HOLDS OWN WEIGHT
VERY THIN VERY LONG (< 7.5 cm)
V. FLOURY NON STICKY
FLOURY WITH SLIGHT GRAININESS, SLIGHTLY STICKY
SOFT AND SMOOTH WITH EVIDENT GRAININESS, LIGHTLY STICKY
MODERATE GRAININESS STICKY
SMOOTH AND FLOURY STICKY
SMOOTH VERY STICKY
SMOOTH VERY STICKY
SILT GRITTINESS
GRITTINESS WITH SOME SAND GRAINS
UNNECESSARY
SAND GRAININESS CLEARLY EVIDENT
SILT GRITTINESS
SILT GRITTINESS
SMOOTH
NO SHINE
NO SHINE
NO SHINE
SLIGHT SHINE
MODERATE SHINE
MODERATE SHINE
VERY SHINY
SILT (Si)
SILT LOAM (SiL)
LOAM (L)
CLAY LOAM (CL)
SILTY CLAY LOAM (SiCL)
SILTY CLAY (SiC)
CLAY (C)
* GUIDE TO FLOURY MATERIAL DESCRIPTIONS
LITTLE - 10% BY VOLUME
SLIGHT - 10-30% BY VOLUME
MODERATE - 30-50% BY VOLUME
VERY - > 50% BY VOLUME
SL.-SLIGHT MOD.-MODERATE V.-VERY WT.-WEIGHT

Figure 8. Procedure for field identification of soil texture (after Jones *et al* 1983).

grid illustrated in each fact sheet. The distribution of some of the most common forest types with respect to moisture and fertility is illustrated in Figure 9.

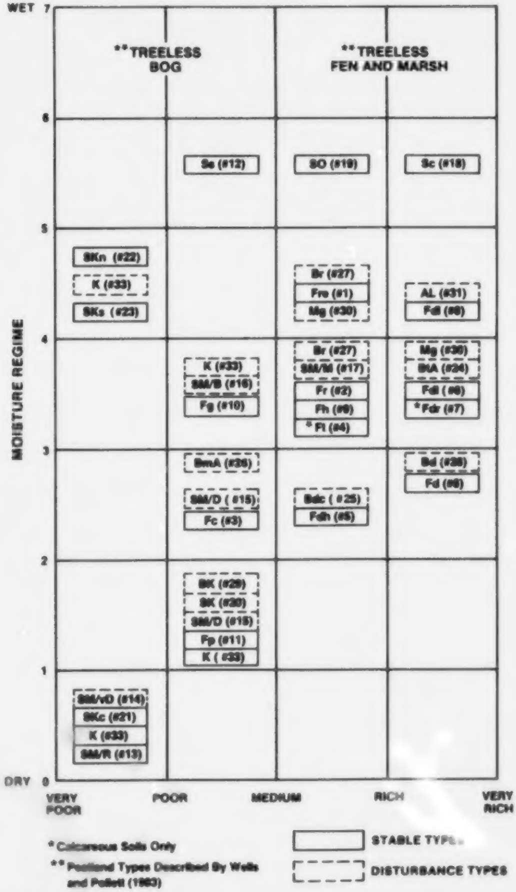


Figure 9. Distribution of forest types with respect to soil moisture and soil fertility.

CHAPTER 6

LANDSCAPE RELATIONSHIPS

The forest types described in this manual do not occur in the landscape at random. Gradients in environmental factors introduce variation in the supply of energy, moisture, nutrients and other factors for which each plant species has a specific tolerance range. Long term natural succession acts on this environmental variation and sorts the regional flora into plant communities having a distinct structure and composition. Thus, a general understanding of how biological and physical factors are related can be of considerable value to forest managers in understanding current conditions and predicting future conditions of the forest landscape.

Foresters are generally most concerned with those landscape features that control tree growth, forest composition and successional trends after disturbance, particularly with respect to regeneration potential and species composition. These properties of the forest are controlled to a large extent by regional climate, soil parent materials, relief and the flora (Jenny 1961, Major 1951). The relative importance of these features varies with the scale of observation, with climate having a dominant influence on a regional level and topography most significant at the local level (Damman 1979, 1983). Understanding the landscape relationship has significance to forest management for several reasons:

1. There are important regional variations in succession and regeneration problems, species composition, etc. Forest management must recognize the need for considerable flexibility in developing unique prescriptions from one management unit to another.

2. Stand reclamation projects usually encompass a variety of forest types. Understanding how the distribution of forest types described in this manual are controlled by topographic variation is fundamental toward the development of mico-site prescriptions on managed forest land.

3. A considerable amount of information can be derived from forest site mapping, particularly with respect to the location and extent of potential regeneration problems and the future composition of forest land. It is beyond the scope of this

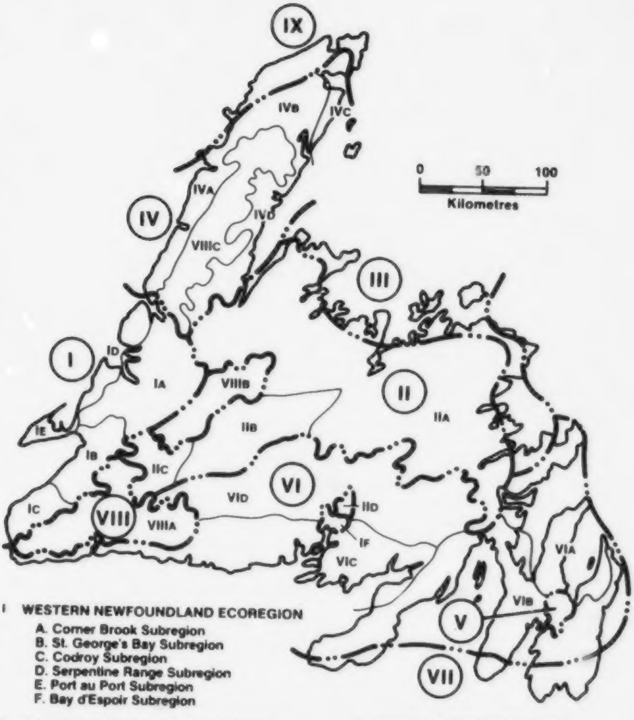
manual to develop mapping methodology, other than to demonstrate how the natural relationships between forest type, climate and topography lends itself to a mapping approach. Good discussions and examples of the benefits and limitations of forest type mapping can be found in Damman (1979), Delaney (1974), Wells and Roberts (1973) and Wells *et al.* (1972).

In this chapter the major climatic subdivisions of Newfoundland are discussed using the ecoregions and subregions defined by Damman (1983). Ecoregions represent areas where a comparable vegetation and soil can be found on sites occupying similar topographic positions on the same parent material provided that these sites have experienced a similar history of disturbance (Damman 1979, 1983). Thus an ecoregion cannot be defined in isolation from the physical landscape, but vegetation toposequence, vegetation structure, floristic composition and floristic distributions can provide the primary criteria (Damman 1979).

In the discussion that follows the topographic relationships of the forest types are illustrated using landtype cross-sections from Damman (1963, 1964 and 1967) and Meades (1986). More in-depth treatment can be found in the original sources since the main intent here is to illustrate how forest types and their topographic relationships vary within the ecoregion context. The description of the landtypes is included within the subregion in which they are considered to be most representative. However, unless specifically stated, it should not be implied that any landtype is restricted to a subregion since geological boundaries frequently override climatic regions (i.e. glacio-fluvial deposits can occur in any subregion). Figure 10 shows the ecoregions and subregions.

I. WESTERN NEWFOUNDLAND ECOREGION

This ecoregion is characterized by a humid climate with a relatively longer frost-free period. It contains some of the most favourable sites for forest growth although there is considerable variation due to altitude and proximity to the coast. The Dryopteris-Hylocomium-Balsam Fir forest type is the zonal forest for this region. The zonal soils are nutrient rich humic podzols with a very dark podzolic B horizon due to humus enrichment. The absence of prolonged dry periods appears to have excluded fires from all but the most coarse textured soils. Consequently, Balsam Fir rather than Black Spruce is the dominant forest cover. Yellow Birch is common and it displays its best growth in protected valleys below 200m elevation. This species also occurs in less vigourous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IVB
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IE
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VIII
VIIIA
VID
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VII

I WESTERN NEWFOUNDLAND ECOREGION
- A. Corner Brook Subregion
- B. St. George's Bay Subregion
- C. Codroy Subregion
- D. Serpentine Range Subregion
- E. Port au Port Subregion
- F. Bay d'Espoir Subregion

II CENTRAL NEWFOUNDLAND ECOREGION
- A. Northcentral Subregion
- B. Red Indian Lake Subregion
- C. Portage Pond Subregion
- D. Twillick Steady Subregion

III NORTH SHORE ECOREGION

IV NORTHERN PENINSULA ECOREGION
- A. Coastal Plain Subregion
- B. Beaver Brook Limestone Subregion
- C. Northern Coastal Subregion
- D. Eastern Long Range Subregion

V AVALON FOREST ECOREGION

VI MARITIME BARRENS ECOREGION
- A. Northeastern Barrens Subregion
- B. Southeastern Barrens Subregion
- C. South Coast Barrens Subregion
- D. Central Barrens Subregion

VII EASTERN HYPER - OCEANIC BARRENS ECOREGION

VIII LONG RANGE BARRENS ECOREGION

IX STRAIT OF BELLE ISLE ECOREGION

Figure 10. Ecoregions and subregions of Insular Newfoundland (after Damman 1983).

forms in the Maritime Barrens and Avalon Forest Ecoregions but it is absent at higher elevations and north of Deer Lake. Red Maple is also most common and robust in this ecoregion.

As a general rule overstocking is a more common silvicultural problem than understocking in western Newfoundland. Localized regeneration failures can occur in forests with a very dense fern and herb stratum such as the Rubus-Balsam Fir and the Dryopteris-Balsam Fir forest types. On these types, hardwoods, particularly Mountain Maple on seepage slopes, can form semi-stable thickets. These thickets may eventually develop into hardwood forest types. The development of ericaceous heath after logging or fire is only observed on very small areas of coarse textured till. This is in stark contrast to central Newfoundland where succession to Kalmia Heath is a common occurrence. The Western Newfoundland Ecoregion is subdivided into six subregions.

IA. Corner Brook Subregion

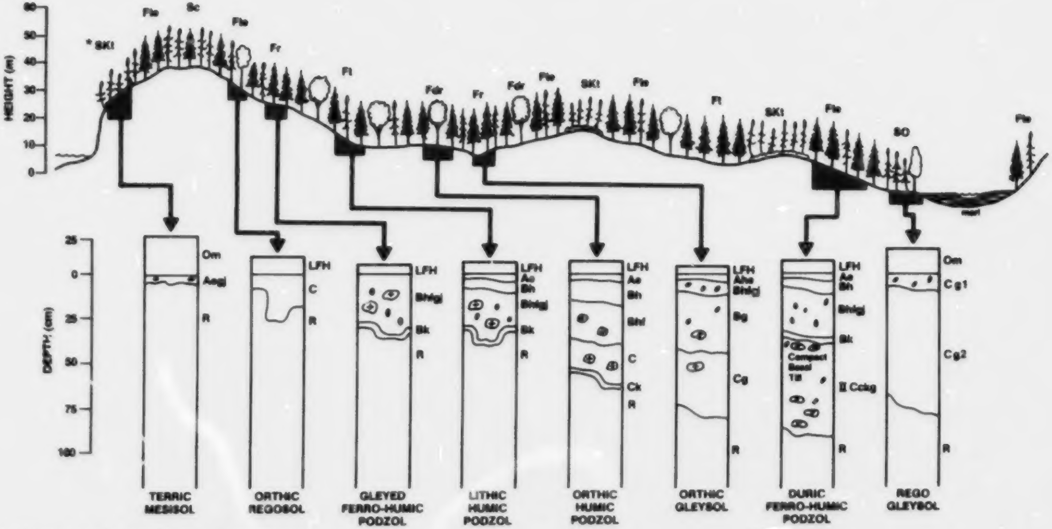
Hilly to undulating terrain from Bonne Bay to Stephenville and east to Grand Lake. The parent materials in this subregion are dominated by slates and limestone till. Areas with calcareous till are distinguished by the occurrence of light colored marl deposits around ponds and in valleys. The parent material consists of shallow, stony silt loam underlain by limestone bedrock or calcareous basal till. The rugged topography is dominated by the Taxus-Balsam Fir and Dryopteris - Rhytidiadelphus - Balsam Fir forest types. (Figure 11).

The hilly, non-calcareous terrain in this subregion is dominated by shallow loamy soils over shale bedrock. However, the shallowness of the till does not adversely effect forest growth since nutrient rich seepage waters are held in the rooting zone by bedrock or a fragipan layer. The steep topography is dominated by the Dryopteris-Balsam Fir forest and supports some of the most productive forest stands in Newfoundland (Figure 12).

IB. St. George's Bay Subregion

This subregion includes the coastal plain and mountain slopes and river valleys from the southern end of Grand Lake to Robinsons River. Areas of deep undulating till occur locally. These are characterized by orthic podzols on sandy loams with the Dryopteris-Hylocomium-Balsam Fir type occurring in the mid-slope position (Figure 13).

On the steep mountainous slopes, gneiss, granite, sandstone and quartz are the most frequently encountered rock types and the parent material is a shallow, often stony, sandy


HEIGHT (m)
60
50
40
30
20
10
0
* SKt
Fle
Sc
Fle
Fr
Ft
Fdr
Fr
Fdr
Fle
SKt
Fle
Ft
SKt
Fle
SO
Fle
marl
DEPTH (cm)
25
0
25
50
75
100
Om
Aegj
R
LFH
C
R
LFH
Bhfgj
Bk
R
LFH
Ae
Bh
Bhfgj
Bk
R
LFH
Ae
Bh
Bhf
C
Ck
R
LFH
Ahe
Bhfgj
Bg
Cg
R
LFH
Ae
Bh
Bhfgj
Bk
Compact Basal Till
II Cckg
R
Om
Cg1
Cg2
R
TERRIC MESISOL
ORTHIC REGOSOL
GLEYED FERRO-HUMIC PODZOL
LITHIC HUMIC PODZOL
ORTHIC HUMIC PODZOL
ORTHIC GLEYSOL
DURIC FERRO-HUMIC PODZOL
REGO GLEYSOL

SKt = Kalmia - Black Spruce - *Taxus* variant.

Figure 11. Distribution of forest types on calcareous bedrock- Western Newfoundland Ecoregion (after Damman 1967).

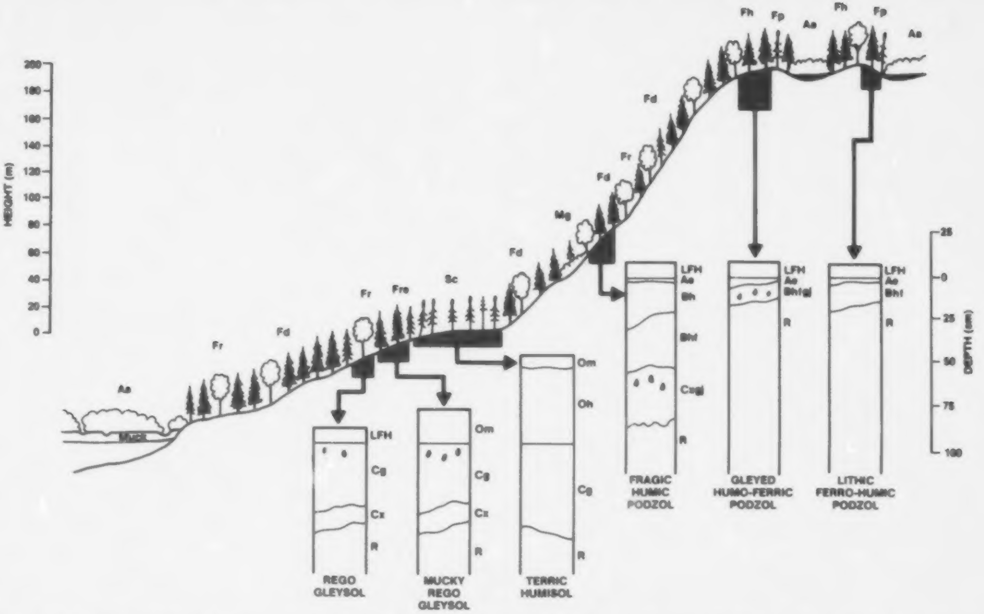

HEIGHT (m)
200
180
160
140
120
100
80
60
40
20
0
Aa
Muck
Fr
Fd
Fr
Fre
Sc
Fd
Mg
Fd
Fr
Fd
Fh
Fp
Aa
Fh
Fp
Aa
LFH
Cg
Cx
R
REGO GLEYSOL
Om
Cg
Cx
R
MUCKY REGO GLEYSOL
Om
Oh
Cg
R
TERRIC HUMISOL
LFH
Ae
Bh
Bhf
Cx(g)
R
FRAGIC HUMIC PODZOL
LFH
Ae
Bhf(g)
R
GLEYED HUMO-FERRIC PODZOL
LFH
Ae
Bhf
R
LITHIC FERRO-HUMIC PODZOL
25
0
25
50
75
100
DEPTH (cm)

Figure 12. Distribution of forest types on hilly topography with shallow soil over shale-Western Newfoundland Ecoregion (after Damman 1967).

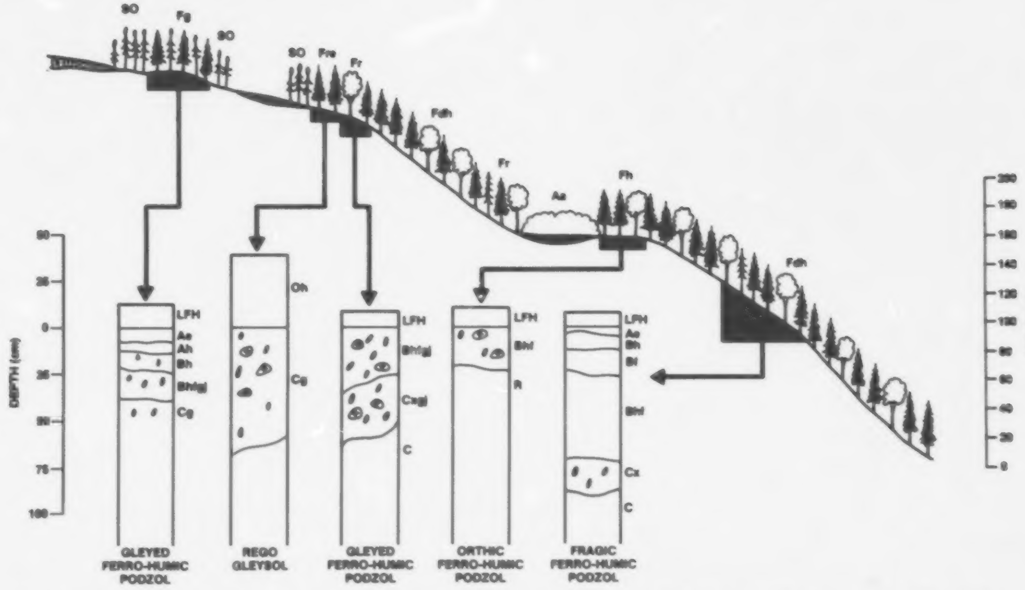

SO
Fg
SO
SO
Fre
Fr
Fdh
Fr
Aa
Fh
Fdh
DEPTH (cm)
50
25
0
25
50
75
100
LFH
Ae
Ah
Bh
Bhf(g)
Cg
Oh
Cg
LFH
Bhf(g)
Cx(g)
C
LFH
Bhf
R
LFH
Ae
Bh
Bf
Bhf
Cx
C
GLEYED FERRO-HUMIC PODZOL
REGO GLEYSOL
GLEYED FERRO-HUMIC PODZOL
ORTHIC FERRO-HUMIC PODZOL
FRAGIC FERRO-HUMIC PODZOL
HEIGHT (m)
200
180
160
140
120
100
80
60
40
20
0

Figure 13. Distribution of forest types on rolling topography with deep till-Western Newfoundland Ecoregion (after Damman 1967).

loam till. The Hylocomium-Balsam Fir forest type occupies the midslope position underlain by orthic or gleyed podzols with seepage over bedrock (Figure 14). The occurrence of seepage waters ensures good forest growth and profuse regeneration after cutting. This landtype is also prevalent in the Corner Brook Subregion.

The coastal plain is dominated by numerous coarse textured deposits, such as glacio-fluvial deposits, eskers, drumlins and kames. The generally, low productivity of these sites is in stark contrast to most of western Newfoundland. Figure 15 illustrates the distribution of the forest types on deep coarse textured glacial till with a gravelly loamy sand texture. The Pleurozium-Balsam Fir and the Gaultheria-Balsam Fir forest types are the most common in undisturbed landscapes but these may be replaced by corresponding Black Spruce-Feathermoss types, Kalmia-Black Spruce or Kalmia Heath after fire. Orthic podzols dominate these landscapes with gleyed humic podzols in transition to large peatland deposits. This is one of the few landtypes in the Western Newfoundland Ecoregion where serious growth and regeneration problems may be encountered.

Ic. Codroy Subregion

The Codroy Subregion extends from Robinsons River to the Cape Anguille Mountains. Climatically, this area has some of the most favorable conditions for growth in Newfoundland and a large portion of the area has been cleared for agriculture. The forested landscape is dominated by steep slopes similar to that shown in Figure 14.

Id. Serpentine Range Subregion

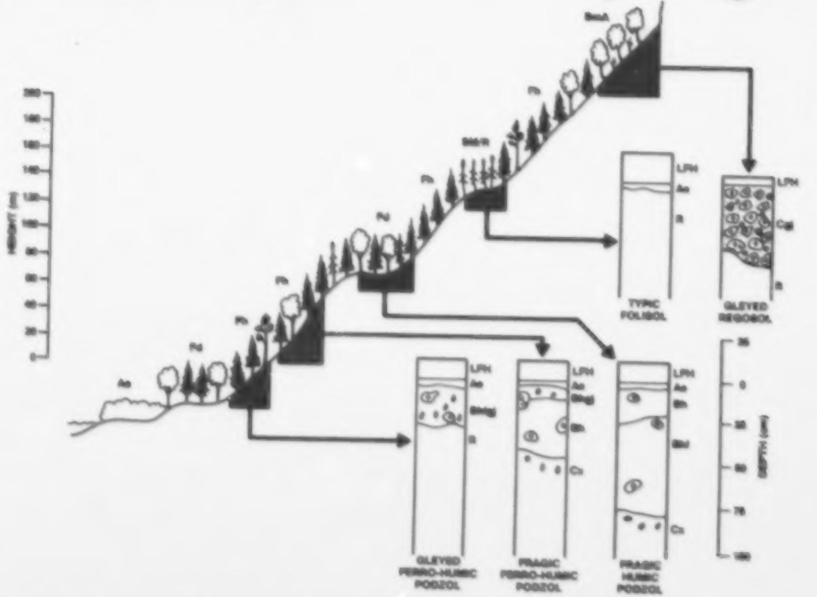
This subregion extends from Blow-Me-Down on the south shore of the Bay of Islands to include the Lewis Hills. The area is mountainous with elevations in excess of 800m and the vegetation is dominated by rock barrens. The serpentine and ultra basic rock types support numerous rare and endemic species of plant.

Ie. Port au Port Subregion

This subregion includes the Port au Port Peninsula. Again the landscape is dominated by rock barren, however, the rock type is dominated by limestone. The Limestone Heaths of the area also support numerous species of rare and endangered plants. Forests are generally unproductive or totally lacking.

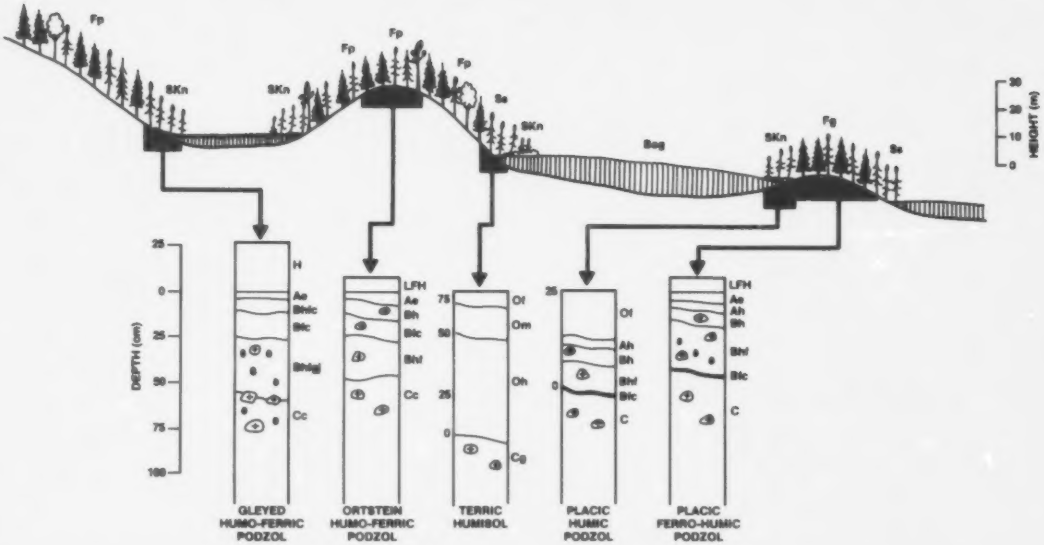
If. Bay d'Espoir Subregion

This small outlier of the Western Newfoundland Ecoregion is in a sheltered valley system on the southeast coast. Excellent stands of the Dryopteris-Balsam Fir forest type dominate the valley slopes similar to that illustrated in Figure 14. However, Mountain Maple



HEIGHT (m)
0
20
40
60
80
100
120
140
160
180
200
LFH
Ae
Bhfg
R
GLEYED FERRO-HUMIC PODZOL
LFH
Ae
Bhfg
Bfh
Cx
FRAGIC FERRO-HUMIC PODZOL
LFH
Ae
Bh
Bhf
Cx
FRAGIC HUMIC PODZOL
LFH
Ae
R
TYPIC FOLISOL
LFH
Cgl
R
GLEYED REGOSOL
DEPTH (cm)
25
0
25
50
75
100

Figure 14. Distribution of forest types on hilly topography with till derived from gneiss, granite, sandstone or quartzite-Western Newfoundland Ecoregion (after Damman 1967).


Fp
SKn
SKn
Fp
Fp
Fp
Ss
SKn
Bog
SKn
Fg
Ss
HEIGHT (m)
30
20
10
0
DEPTH (cm)
25
0
25
50
75
100
H
Ae
Bhfc
Bfc
Bhfgj
Cc
GLEYED HUMO-FERRIC PODZOL
LFH
Ae
Bh
Bfc
Bhf
Cc
ORTSTEIN HUMO-FERRIC PODZOL
75
50
25
0
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Om
Oh
Cg
TERRIC HUMISOL
25
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Of
Ah
Bh
Bhf
Bfc
C
PLACIC HUMIC PODZOL
LFH
Ae
Ah
Bh
Bhf
Bfc
C
PLACIC FERRO-HUMIC PODZOL

Figure 15. Distribution of forest types on deep, coarse textured glacial till-Western Newfoundland Ecoregion (after Damman 1967).

Thickets and Trembling Aspen are generally lacking in these stands.

II. CENTRAL NEWFOUNDLAND ECOREGION

Central Newfoundland has the most continental climate of any part of insular Newfoundland. It has the highest summer temperatures and lowest winter temperatures, however, night frost can occur in any summer month. Due to the warm summer and high evapo-transpiration losses, soils in the northern part of this ecoregion display soil moisture deficiency.

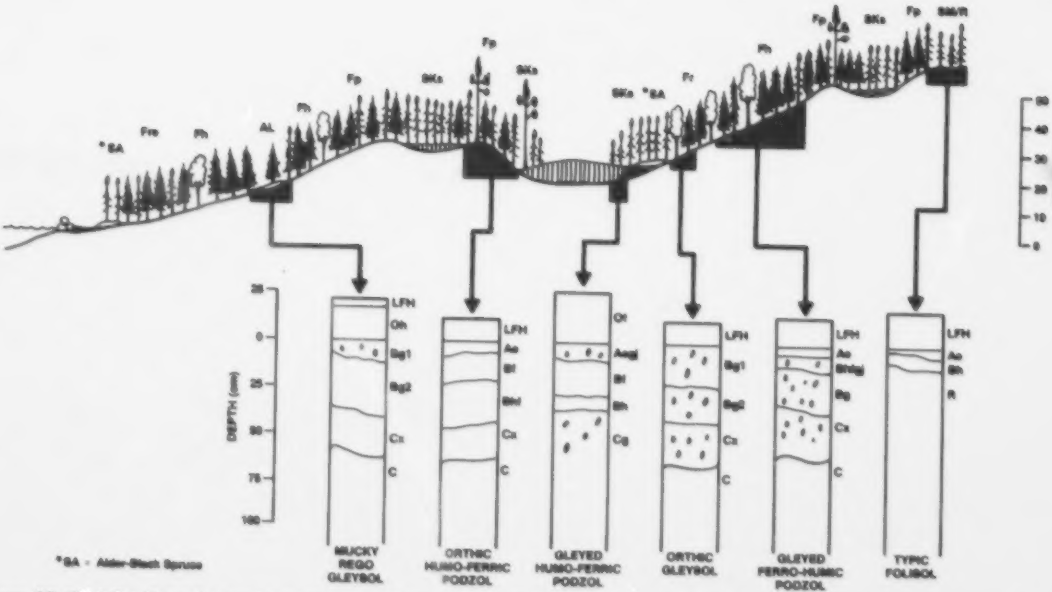
The Hylocomium-Balsam Fir forest type occupies the zonal soils of this area. These soils are generally lighter in color and have lower organic matter content compared to other ecoregions. Forest fires have played a more important role in the natural history of this region relative to other ecoregions. Much of the Balsam Fir-Feathermoss forest types have been converted to Black Spruce and some of the richer site types to hardwood forests dominated by White Birch and Aspen. Although Aspen occurs in other regions, it is most abundant and vigorous in central Newfoundland. Yellow Birch is absent from this region primarily because of the short frost-free period. Alders rather than Mountain Maple are the most common problem on wet seepage slopes.

The Central Newfoundland Ecoregion has four subregions:

IIA. Northcentral Subregion

The Northcentral Subregion has higher summer maximum temperatures, lower rainfall and higher fire frequency than anywhere else in Newfoundland. The subregion extends from Clarenville in the east to Deer Lake in the west and for the most part has a rolling topography below 200m. Pure Black Spruce forests and Aspen stands dominate this area because of the prevalence of fire in the natural history of the subregion. Also, the high summer temperatures are thought to stimulate Aspen root suckering and contribute to the local success of Aspen (Damman 1983). Relatively low moisture, coarse soils and the prevalence of Black Spruce cover types make this subregion particularly susceptible to regeneration failure. Furthermore, where tree regeneration is lacking, succession to dwarf shrub heath dominated by *Kalmia angustifolia* occurs on the nutrient-poor coarse textured till that is prevalent through much of this area.

The rolling to undulating topography is characterized by shallow, medium quality till with a soil texture range from sandy loam to loam. Midslopes are dominated by the Hylocomium-Balsam Fir type, or the Black Spruce-Feathermoss type on seepage gleysols after fire (Figure 16). There are also local areas covered by poor sandy till over glacio-fluvial deposits and outwash deposits along



*SA
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AL
Fh
Fp
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Fp
SKs
SKs
*SA
Fr
Fh
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SKs
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HEIGHT (m)
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DEPTH (cm)
25
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25
50
75
100
LFH
Oh
Bg1
Bg2
Cx
C
LFH
Ae
Bf
Bhf
Cx
C
Of
Aegj
Bf
Bh
Cg
LFH
Bg1
Bg2
Cx
C
LFH
Ae
Bhfgj
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Cx
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Bh
R
MUCKY REGO GLEYSOL
ORTHIC HUMO-FERRIC PODZOL
GLEYED HUMO-FERRIC PODZOL
ORTHIC GLEYSOL
GLEYED FERRO-HUMIC PODZOL
TYPIC FOLISOL

*SA - Alder-Black Spruce

Figure 16. Distribution of forest types on medium textured till-Central Newoundland Ecoregion (after Damman 1984).

some of the major river systems such as the Terra Nova, Exploits and Indian River (Figure 17). It is in these landtypes that succession of productive Black Spruce forest types to ericaceous heath dominated by *Kalmia angustifolia* is most prevalent.

IIB. Red Indian Lake Subregion

This subregion is cooler than subregion A with more precipitation and a shorter growing season. Balsam Fir cover types predominate and White Birch rather than Black Spruce is most prominent in the landscape.

Much of the topography of this subregion is similar to subregion A (Figures 16 and 17), however there are some local areas of deeper, nutrient-rich till. The southern slopes of Red Indian Lake and the Noel Paul and Harpoon River systems provide good examples of this richer landtype (Figure 18). The Rubus-Balsam Fir and Dryopteris-Lycopodium-Balsam Fir types dominate the landtype. The soils have a texture ranging from silt loam to loam usually with a fragipan that promotes seepage in the rooting zone. These are by far the most productive forest types in central Newfoundland. However, succession to Alder thickets after cutting and fire is a serious silvicultural problem.

IIc. Portage Pond Subregion

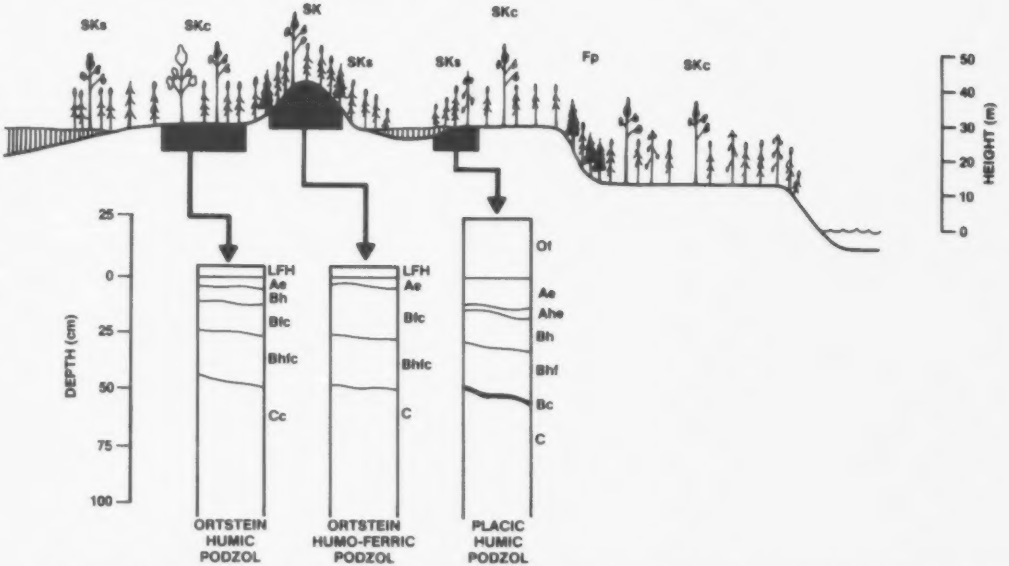
This subregion is characterized by rugged topography including the Annieopsquotch Mountains. Balsam Fir is the dominant tree on upland sites. However, there are a number of very productive Black Spruce fire stands in this subregion.

IID. Twillick Steady Subregion

This subregion occurs immediately to the north of the Bay d'Espoir Subregion of the Western Newfoundland Ecoregion. Trembling Aspen is absent from this area and Balsam Fir is the most common upland cover type.

III. NORTH SHORE ECOREGION

This ecoregion represents a narrow coastal zone 20-25km in width extending from Bonavista Bay to the Baie Verte Peninsula. Black Spruce and Balsam Fir form a continuous forest except where barrens dominate on the coastal headlands. White Spruce is more common than in central Newfoundland but Trembling Aspen is sporadic and rarely forms pure stands. *Alnus crispa* replaces *Alnus rugosa* as the dominant alder on both upland and lowland sites. The vegetation season is shorter and cooler than in Central Newfoundland but the frost-free period is several weeks longer. The summers are relatively dry and warm and soil moisture deficiencies may occur. As with the Central Newfoundland Ecoregion, encroachment of erica-


SKs
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SK
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SKs
SKc
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SKc
HEIGHT (m)
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DEPTH (cm)
25
0
25
50
75
100
LFH
Ae
Bh
Bfc
Bhfc
Cc
ORTSTEIN HUMIC PODZOL
LFH
Ae
Bfc
Bhfc
C
ORTSTEIN HUMO-FERRIC PODZOL
Of
Ae
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PLACIC HUMIC PODZOL

Figure 17. Distribution of forest types on coarse textured till-Central Newfoundland Ecoregion (after Damman 1964).

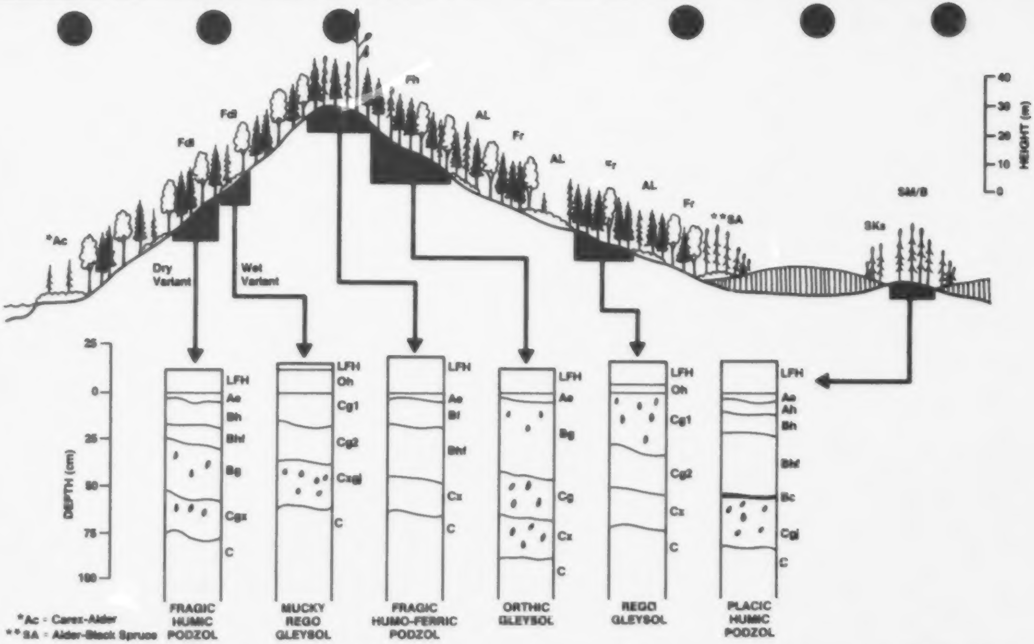

*Ac
Fdl
Fdl
Fh
AL
Fr
AL
Fr
AL
Fr
**SA
SKs
SM/B
Dry Variant
Wet Variant
HEIGHT (m)
40
30
20
10
0
DEPTH (cm)
25
0
25
50
75
100
LFH
Ae
Bh
Bhf
Bg
Cgx
C
FRAGIC HUMIC PODZOL
LFH
Oh
Cg1
Cg2
Cxgj
C
MUCKY REGO GLEYSOL
LFH
Ae
Bf
Bhf
Cx
C
FRAGIC HUMO-FERRIC PODZOL
LFH
Ae
Bg
Cg
Cx
C
ORTHIC GLEYSOL
LFH
Oh
Cg1
Cg2
Cx
C
REGO GLEYSOL
LFH
Ae
Ah
Bh
Bhf
Bc
Cgj
C
PLACIC HUMIC PODZOL
*Ac = Carex-Alder
**SA = Alder-Black Spruce

Figure 18. Distribution of forest types on loam to silty loam textured, nutrient-rich till-Central Newfoundland Ecoregion (after Damman 1964).

ceous shrubs on dry nutrient-poor sites after cutting and fire is a serious silvicultural problem. Also, the quality of growth diminishes with proximity to the coastline. There are no subregions in this ecoregion. The landtypes are similar to those illustrated for the Central Newfoundland Ecoregion.

IV. NORTHERN PENINSULA ECOREGION

This ecoregion differs from most other forested parts of the Island by the shortness of the vegetation season, 110-150 days compared to 145-170 days for other areas. The frost-free period is comparable to most other areas and somewhat better than in central Newfoundland. Precipitation is lower but because of low summer temperatures and shorter vegetation season, soil moisture supply is probably adequate at most times. The soils are comparable to those of western Newfoundland. Limestone underlies most of the region, with acidic rocks more common on the eastern side of the peninsula.

Balsam Fir is the dominant forest cover except at high elevations (300-400m) on the eastern side of the peninsula where Black Spruce appears to be a natural component of the stands. There is very little fire history in this ecoregion. White Pine, Red Maple, Yellow Birch and Trembling Aspen are conspicuous by their absence. There are approximately 100 species of plants that are excluded from this ecoregion presumably because of the difference of climate (Damman 1965, 1976 and 1983). One of the most conspicuous changes is the replacement of *Alnus rugosa* by *Alnus crispa*, *Salix pellita* and *Salix planifolia* in swamps. Also tall shrubs such as *Nemopanthus mucronata*, *Viburnum cassinoides* and *Rhododendron canadense* are sparse or lacking in the scrub bog-border forests. Silviculturally, they are similar to western Newfoundland with hardwoods rather than ericaceous shrubs being the most common brush problem on understocked cutovers. *Ribes glandulosum*, *Ribes triste* and *Cornus stolonifera* appear to be a much more conspicuous component of seral vegetation on cutovers. Raspberry is also very abundant in the early years of succession.

This ecoregion is subdivided into four subregions:

IVA. Coastal Plain Subregion

This includes the western side of the Great Northern Peninsula to the lower slopes of the Long Range Mountains. Most of the coastal plain is dominated by bogs and scrub forest. The area around Hawkes Bay and the foothills of the mountains are important exceptions to this generalization.

IVB. Beaver Brook Limestone Subregion

This subregion occupies the central lowlands north of the Highlands of St. John on the Great Northern Peninsula. This sheltered outlier maintains the most productive forests in the ecoregion comparable in productivity to parts of western Newfoundland. Limestone, shale and sandstone bedrock types occur in this area.

The limestone landtype occurs predominantly on the east side of the peninsula between Roddickton and Main Brook (Figure 19). As in western Newfoundland, the limestone landtypes are characterized by marl deposits around ponds and in valleys. The soils have a distinct dark greyish brown layer in contact with bedrock, compacted till or large boulders. The landscape is gently rolling with the Rubus-Balsam Fir and Taxus-Balsam Fir the most common forest types with Pleurozium-Balsam Fir occurring on shallow till.

On the western side of the peninsula east and south of Ten Mile Pond the till is formed from sandstone. The landscape is undulating to hilly in the extreme west. The Dryopteris-Balsam Fir and Clintonia-Balsam Fir types are most common on moderate to deep tills. On shallow tills the Pleurozium-Balsam Fir and Black Spruce-Feathermoss on bedrock are dominant (Figure 20). Soil textures in these types are generally sandy loam to loamy sand.

In the centre of the peninsula between Route 432 and Salmon River, shale is the dominant bedrock type and the gently rolling topography is formed from till with a loam to silt loam texture. Rubus-Balsam Fir and Clintonia-Balsam Fir types are dominant.

IVC. Northern Coastal Subregion

This subregion is dominated by exposed, rocky dwarf shrub barrens with local areas of unmerchantable forest.

IVD. Eastern Long Range Subregion

This subregion includes the productive but inaccessible forest on the eastern slopes of the Long Range Mountains up to 450m elevation. The forests tend to be somewhat open Balsam Fir - Black Spruce mixtures. Treeline decreases towards the northern end of the subregion.

V. AVALON FOREST ECOREGION

This ecoregion represents a sheltered outlier within the more open and exposed Maritime Barrens Ecoregion. Pure stands of Balsam Fir with a

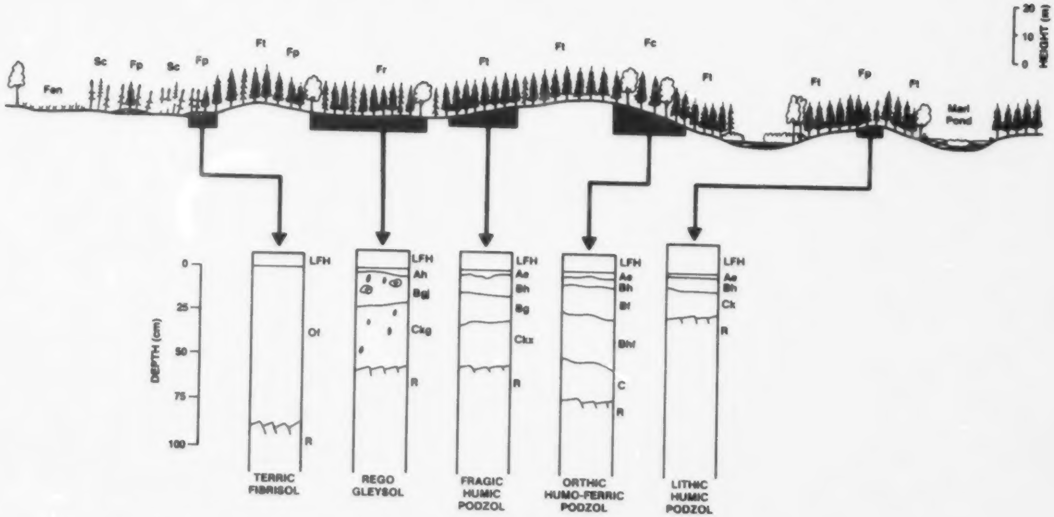
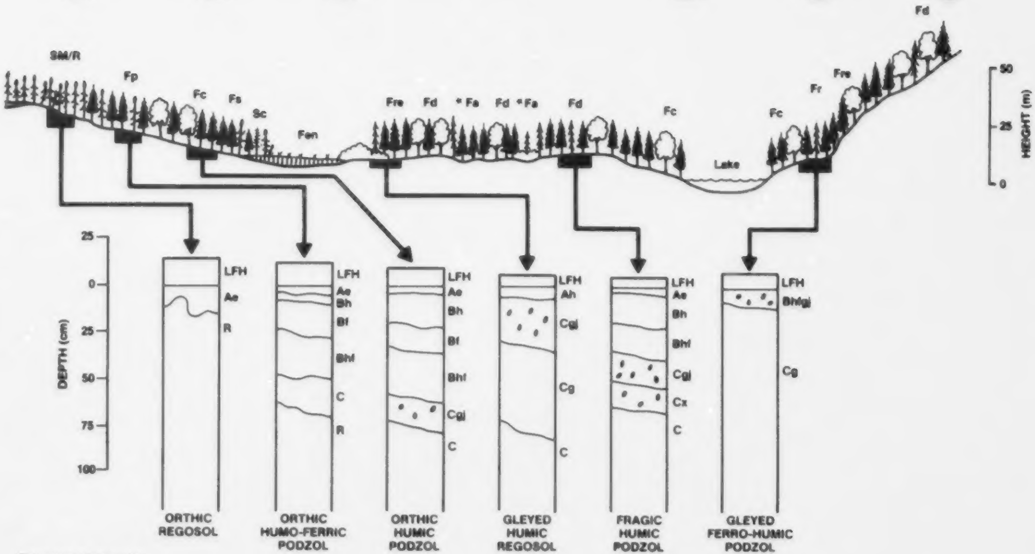

Fen
Sc
Fp
Sc
Fp
Ft
Fp
Fr
Ft
Ft
Fc
Ft
Ft
Fp
Ft
Marl Pond
20
10
0
HEIGHT (m)
DEPTH (cm)
0
25
50
75
100
LFH
Of
R
TERRIC FIBRISOL
LFH
Ah
Bgj
Ckg
R
REGO GLEYSOL
LFH
Ae
Bh
Bg
Ckx
R
FRAGIC HUMIC PODZOL
LFH
Ae
Bh
Bf
Bhf
C
R
ORTHIC HUMO-FERRIC PODZOL
LFH
Ae
Bh
Ck
R
LITHIC HUMIC PODZOL

Figure 19. Distribution of forest types on limestone bedrock, characteristic of the Beaver Brook Limestone Subregion - Northern Peninsula Ecoregion (after Damman 1963).



SM/R
Fp
Fc
Fs
Sc
Fen
Fre
Fd
*Fa
Fd
*Fa
Fd
Fc
Lake
Fc
Fr
Fre
Fd
50
25
0
HEIGHT (m)
25
0
25
50
75
100
DEPTH (cm)
LFH
Ae
R
LFH
Ae
Bh
Bf
Bhf
C
R
LFH
Ae
Bh
Bf
Bhf
Cgj
C
LFH
Ah
Cgj
Cg
C
LFH
Ae
Bh
Bhf
Cgj
Cx
C
LFH
Bhfgj
Cg
ORTHIC REGOSOL
ORTHIC HUMO-FERRIC PODZOL
ORTHIC HUMIC PODZOL
GLEYED HUMIC REGOSOL
FRAGIC HUMIC PODZOL
GLEYED FERRO-HUMIC PODZOL

*Fa = Alder-Balsam Fir

Figure 20. Distribution of forest types on parent materials derived from sandstone, characteristic of Ten Mile Pond in the Beaver Brook Limestone Subregion - Northern Peninsula Ecoregion (after Damman 1963).

significant mixture of White Birch and Yellow Birch dominate this region. Trembling Aspen is rare and Black Spruce is only abundant on wet site types. The Avalon Forest Ecoregion has been spared the ravages of fire that decimated forests in the surrounding landscape converting it to open heathland.

The excessively moist climate and ribbed moraine topography give this small (500km^2) ecoregion its uniqueness. The excessive fog frequency is clearly expressed by the abundance of pendant lichens hanging from the branches of Balsam Fir. Aspect appears to be an important factor controlling forest composition and growth (Delaney and Cahill 1978). North facing slopes are dominated by the Dryopteris-Balsam Fir type whereas south slopes have Clintonia-Balsam Fir and Nemopanthus-Kalmia-Black Spruce with *Taxus canadensis* abundant (Figure 21). Gleyed Ferro-Humic Podzols with loam to silt-loam texture dominate in the landtype.

Silviculturally, these sites are difficult to manage because of the considerable difference in ecological conditions over a very small area. Understocked sites (which are generally rare) have an ericaceous heath vegetation on slope summits with birch and raspberry on the slopes. Also, these forests are subject to considerable climatic stress from wind and large clearcuts should be discouraged. The low abundance of Black Spruce in these forests suggest they would be prone to softwood regeneration failure after fire.

VI. MARITIME BARRENS ECOREGION

The Maritime Barrens Ecoregion extends from the east coast of Newfoundland to the west coast through the south central portion of the Island. This ecoregion has the coldest summers with frequent fog and strong winds. Winters are relatively mild with intermittent snow cover particularly near the coastline. Annual precipitation exceeds 1250mm.

The landscape pattern consists of usually stunted, almost pure stands of Balsam Fir broken by extensive open heathland. Good forest growth is localized on long slopes of a few protected valleys. The development of the extensive heath landscape was precipitated by indiscriminate burning by European settlers. Railways in the nineteenth century also had a significant impact on fire frequency in the eastern part of the region. The heaths are dominated by *Kalmia angustifolia* on protected slopes where snow accumulates and by cushions of *Empetrum nigrum* or *Empetrum eamesii* on windswept ridges and headlands.

Attempts to afforest these heaths with *Picea sitchensis* have been unsuccessful but Eastern Larch and Scots Pine

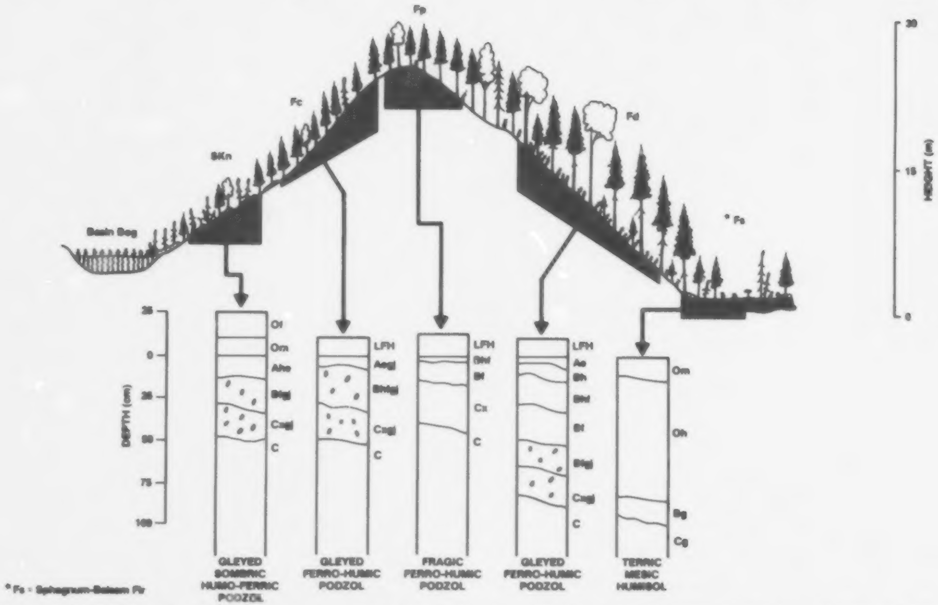

Fp
Fc
bKn
Basin Bog
Fd
* Fs
30
15
0
HEIGHT (m)
DEPTH (cm)
25
0
25
50
75
100
Of
Om
Ahe
Bfgj
Ccgj
C
LFH
Aegj
Bhfgj
Ccgj
C
LFH
Bhf
Bf
Cx
C
LFH
Ae
Bh
Bhf
Bf
Bfgj
Ccgj
C
Om
Oh
Bg
Cg
GLEYED SOMBRIC HUMO-FERRIC PODZOL
GLEYED FERRO-HUMIC PODZOL
FRAGIC FERRO-HUMIC PODZOL
GLEYED FERRO-HUMIC PODZOL
TERRIC MESIC HUMISOL
* Fs - Sphagnum-Balsam Fir

Figure 21. Distribution of forest types on ribbed moraine-Avalon Forest Ecoregion (after Meades 1986).

may have potential for fuelwood stands (Hall 1986). However, site selection is critical because the historical removal of forest has deflected the natural treeline to low elevations. Figure 22 illustrates the relationship between the natural and anthropogenic landscape created by burning and the impact this has had on the local treeline. Wind, lack of protective snow cover and soil frost disturbance are important factors limiting plantation establishment in this ecoregion. The Maritime Barrens Ecoregion is divided into four subregions:

VIA. Northeastern Barrens Subregion

This subregion has lower fog frequency and somewhat warmer summers compared to subregions B and C. Arctic-alpine species are absent from the heath vegetation and Yellow Birch is absent from the forest. The landscape is extensively forested with local heath vegetation particularly along the coast.

The tills in the area are generally a shallow rolling ground moraine with sandy loam to loam texture. The Hylocomium-Balsam Fir type occupies midslopes and it is usually associated with gleyed podzols or gleysols (Figure 23).

VIB. Southeastern Barrens Subregion

In this subregion the landscape is dominated by heathlands and the forest only occurs in small acreages which escaped fire. The dominant heath shrub on uplands is *Empetrum nigrum* with *Kalmia angustifolia* forming a dense cover only in protected valleys.

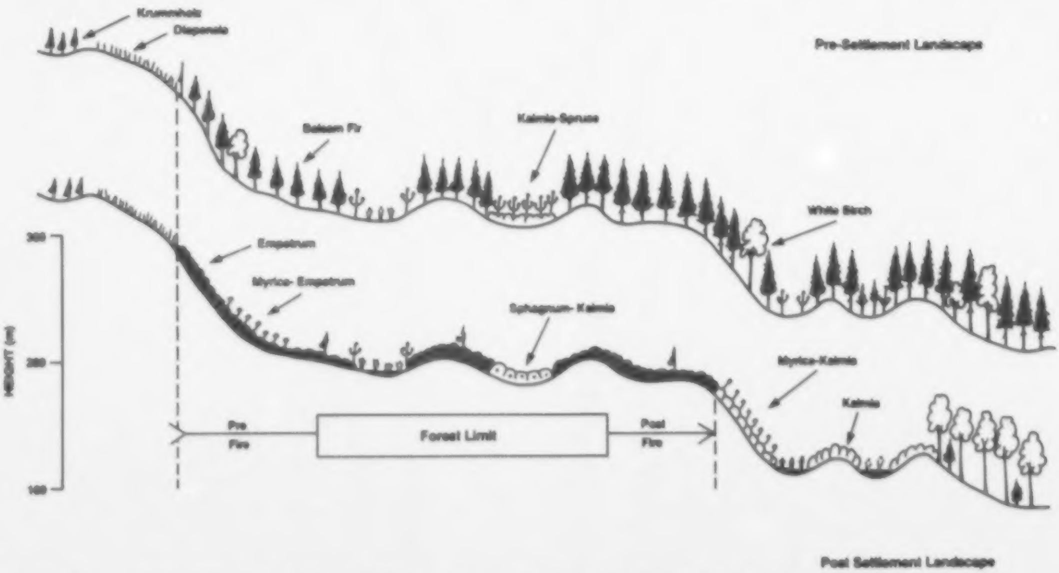
The topography is generally undulating with shallow heavily compacted till and numerous large erratics. The Clintonia-Balsam Fir type is most common where the forest is still present (Figure 24). Good forest growth only occurs in a few large protected valleys where the Dryopteris-Balsam Fir type dominates the slopes (Figure 25). Good specimens of Yellow Birch are also found in these stands.

VIC. South Coast Barrens Subregion

This subregion includes the higher elevations along the south coast and a few small outliers on the Isthmus of Avalon and the Hawke Hills that are up to 300m in elevation. Snow cover is shallow and arctic-alpine plants occur locally. Yellow Birch is present in valleys.

VID. Central Barrens Subregion

This area occurs south of the Central Newfoundland Ecoregion and north of the South Coast Barrens Subregion. Residual forests that have not been destroyed by fire have moderate forest capability. The



Krummholz
Diapensia
Pre-Settlement Landscape
Balsam Fir
Kalmia-Spruce
White Birch
300
200
100
HEIGHT (m)
Empetrum
Myrica- Empetrum
Sphagnum- Kalmia
Myrica-Kalmia
Kalmia
Pre
Fire
Forest Limit
Post
Fire
Post Settlement Landscape

Figure 22. Successional relationships between forest and heath types following increase in anthropogenic fire frequency - Maritime Barrens Ecoregion (after Meades 1986).

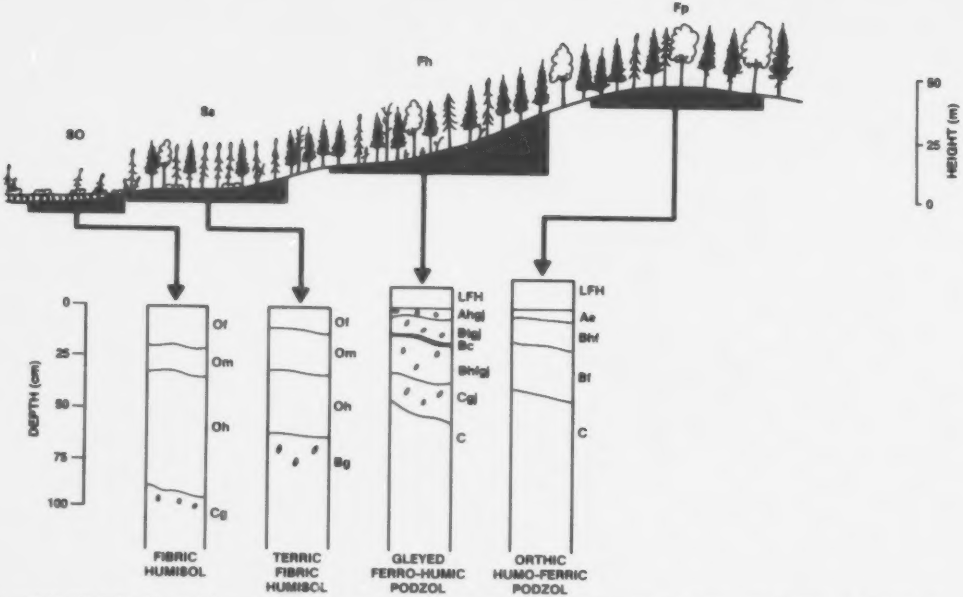
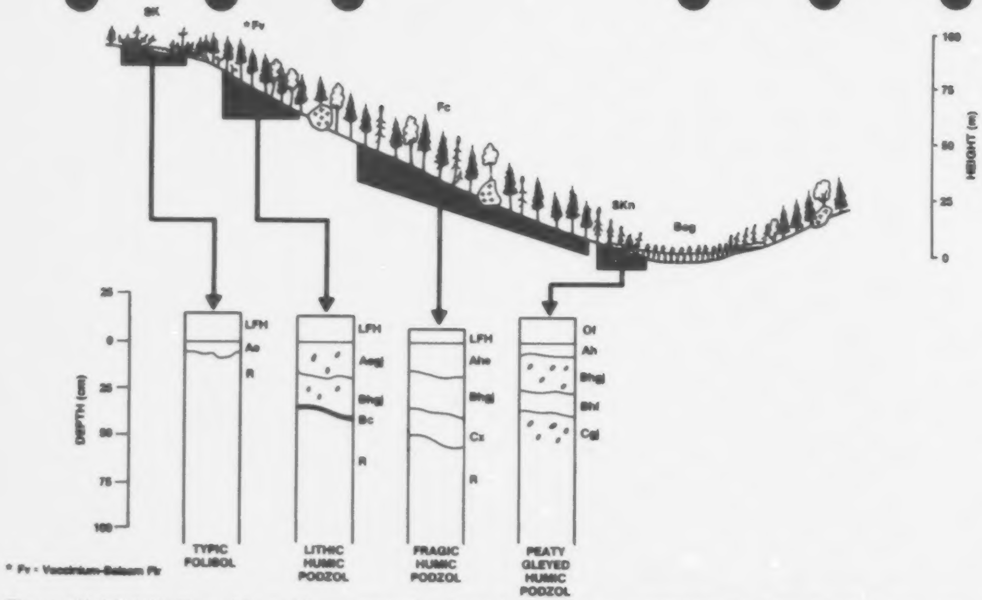

SO
Sa
Fh
Fp
HEIGHT (m)
0
25
50
DEPTH (cm)
0
25
50
75
100
Of
Om
Oh
Cg
FIBRIC HUMISOL
Of
Om
Oh
Bg
TERRIC FIBRIC HUMISOL
LFH
Ahgj
Bfgj
Bc
Bhfgj
Cgj
C
GLEYED FERRO-HUMIC PODZOL
LFH
Ae
Bhf
Bf
C
ORTHIC HUMO-FERRIC PODZOL

Figure 23. Distribution of forest types on rolling topography with shallow till, characteristics of the Northern Barrens Subregion-Maritime Barrens Ecoregion (after Meades 1986).


SK
* Fv
Fc
SKn
Bog
HEIGHT (m)
100
75
50
25
0
DEPTH (cm)
25
0
25
50
75
100
LFH
Ae
R
LFH
Aegj
Bhgj
Bc
R
LFH
Ahe
Bhgj
Cx
R
Of
Ah
Bhgj
Bhl
Cgj
TYPIC FOLISOL
LITHIC HUMIC PODZOL
FRAGIC HUMIC PODZOL
PEATY GLEYED HUMIC PODZOL

* Fv : Vaccinium-Balsam Fir

Figure 24. Distribution of forest types on undulation topography, characteristic of the Southeastern Barrens Subregion-Maritime Barrens Ecoregion (after Meades 1986).

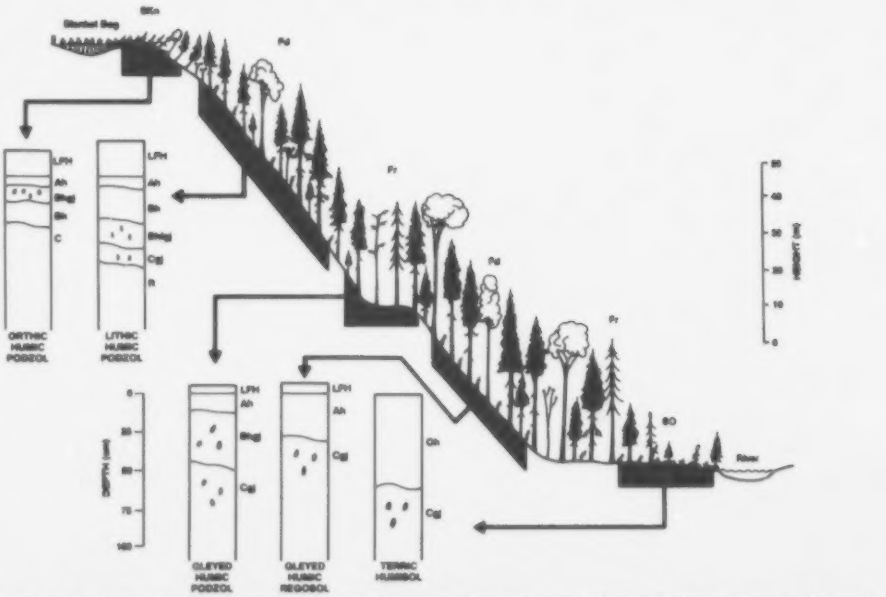

Blanket Bog
SKn
Pd
Fr
Pd
Fr
BO
River
LFH
Ah
Bh(g)
Bh
C
ORTHIC HUMIC PODZOL
LFH
Ah
Bh
Bh(g)
Cg
R
LITHIC HUMIC PODZOL
LFH
Ah
Bh(g)
Cg
GLEYED HUMIC PODZOL
LFH
Ah
Cg
GLEYED HUMIC REGOSOL
Oh
Cg
TERRIC HUMISOL
DEPTH (cm)
0
25
50
75
100
HEIGHT (m)
0
10
20
30
40
50

Figure 25. Distribution of forest types on hilly topography, characteristic of the valley systems in the Southeastern Barrens Subregion-Maritime Barrens Ecoregion (after Meades 1986).

dwarf shrub heaths are robust and *Rhododendron canadense* is a conspicuous component suggesting deep snow cover. Arctic-alpine species are poorly represented and Yellow Birch is absent from the forest.

VII. EASTERN HYPER-OCEANIC BARRENS ECOREGION

This ecoregion occurs on the extreme south coast of the Avalon and Burin Peninsulas and on the northeast coast near Bay de Verde and Cape Freels. Although this ecoregion is 200m or less in elevation the extreme oceanic climate precludes the development of forest other than Balsam Fir krummholz. The heaths in this area have a close affinity to oceanic parts of northern Scotland and southern Norway (Meades 1983).

VIII. LONG RANGE BARRENS ECOREGION

This ecoregion includes the mountainous areas above treeline. Trees only occur as krummholz usually dominated by Black Spruce and Eastern Larch. Small patches of forest may occur in sheltered valleys. The vegetation is dominated by arctic-alpine plants clearly indicating that these barrens, unlike the Maritime Barrens, were never forested. For subregions of this ecoregion see Damman (1983).

IX. STRAIT OF BELLE ISLE ECOREGION

This ecoregion is dominated by an almost treeless tundra vegetation. White Spruce and Balsam Fir occur as krummholz interspersed with arctic-alpine plants even near sea level. The soils are generally very shallow and outcrops of calcareous bedrock are common throughout. Large stone polygons created by freeze-thaw cycles are common on shallow-exposed mineral soil. Rare and endangered species of calciphilic plants are numerous in these rock barrens.

CHAPTER 7

PLANT IDENTIFICATION

The plants illustrated in this chapter are the differential species used to identify the forest types in the keys. The more common species which occur throughout the forest types are not treated here.

The number next to each species name is the same as the number listed in brackets after the plant names in the keys to the forest types. This facilitates cross-reference between the keys and the plant illustrations.

The plants are arranged according to growth forms. The headings used are: Shrubs, Dwarf Woody Plants, Ferns, Fern Allies, Grasses, Sedges, Forbs, Mosses, and Lichens. Arrangement within groups is alphabetical. A list of plants included under each group is given in the Table of Contents.

Each illustration has a drawing of the entire plant or a representative portion. For many plants, flowers, fruits, or other parts are also illustrated. Numbered arrows indicate diagnostic characters and are cross-referenced in the text. Most traits referred to are easily recognizable in the field. In the case of mosses, a hand lens is helpful to distinguish leaf shape and details.

The size of the plant or detailed part is indicated by a scale. Where there is only one scale, it refers to all of the drawings on the page.

Species names follow Fernald (1970) for vascular plants; Crum and Anderson (1981) for non-Sphagnum mosses; Crum (1984) for *Sphagnum*; and Hale (1969) for lichens. To maintain continuity with the original forest type descriptions (Damman 1964 and 1967), recent nomenclatural changes have not been used. The one exception is *Sphagnum nemoreum* Scop. which follows Nyholm (1969). Where appropriate, commonly used synonyms or similar species are listed as a notation at the end of the description. For simplicity, only one common name is listed for most plants; in some cases, there are no known common names.

The descriptions are as similar in format as possible to allow for easy comparison. In a few plant groups, information about some characters is only given if it is necessary to distinguish between similar species. For example, in the mosses, the sporophytes are either too uncommon or too similar to aid in identification, except in the Dicranums, where the number of sporophytes is diagnostic. Complex terminology is kept to a minimum in the plant descriptions, and all terms are defined in the glossary. Some words may have broader or alternate meanings, but the definitions here refer only to how the terms are used in this manual.

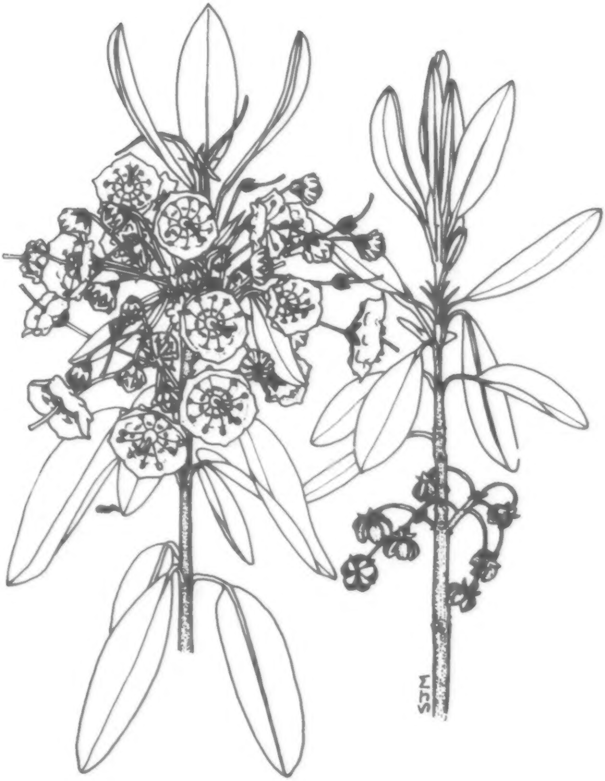
In the lichens, a chemical test may be necessary to verify identification. This P test is done by applying, to the branch tips, a few drops of freshly prepared saturated solution of paraphenylenediamine in 90% ethanol. A positive response is indicated by a change in color to red or orange, a negative response is indicated by no color change.

The moisture and nutrient requirements of each plant are illustrated with an edaphic grid similar to the one in the fact sheets. Solid shading indicates where the plants are at their greatest abundance in undisturbed forest habitats. A plus (+) shows the plant can occur in this ecological position, but with lower cover and often reduced vigor.

Displayed on one page for each species are the pen and ink drawing, the description, and the edaphic grid. Color photographs of each plant are located in a separate section following the illustrations (page 7-95).

Additional information about the plants can be obtained from many sources. Newcomb (1977), is a popular treatment of forbs and flowering shrubs with excellent illustrations. For more technical treatments see Fernald (1970) or Gleason (1974) for vascular plants; Ryan (1978) for trees, shrubs and woody plants; Cobb (1963) for ferns and fern allies; Crum and Anderson (1981) and Crum (1984) for mosses; or Hale (1969) for lichens.

PLANT ILLUSTRATIONS

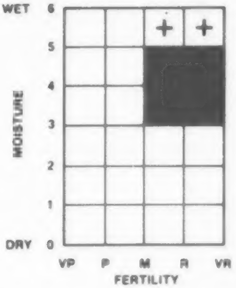


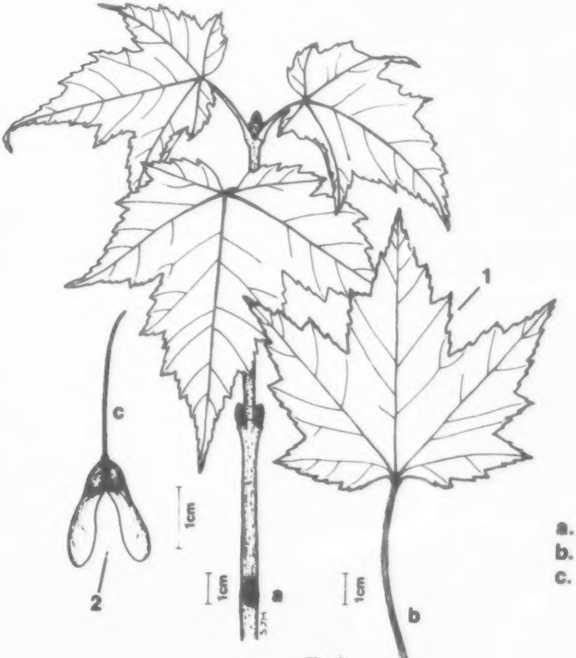
Kalmia angustifolia

Acer rubrum
Red Maple

1

form: Small to medium tree. Twigs smooth; red, bud scales 4, dark red.
leaves: Opposite, 6-10 cm long, petioled, green and smooth-textured above, pale beneath, and mostly smooth. 1. Blade divided into 3-5 main lobes, tips pointed, margins deeply cut and double-toothed, lower sides of the center lobe often parallel.
flowers: Red, several in dense clusters near twig ends, appearing before the leaves.
fruit: A pair of winged samaras, red. 2. Angle between the wings narrow.



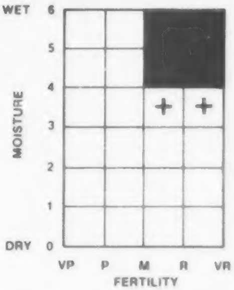


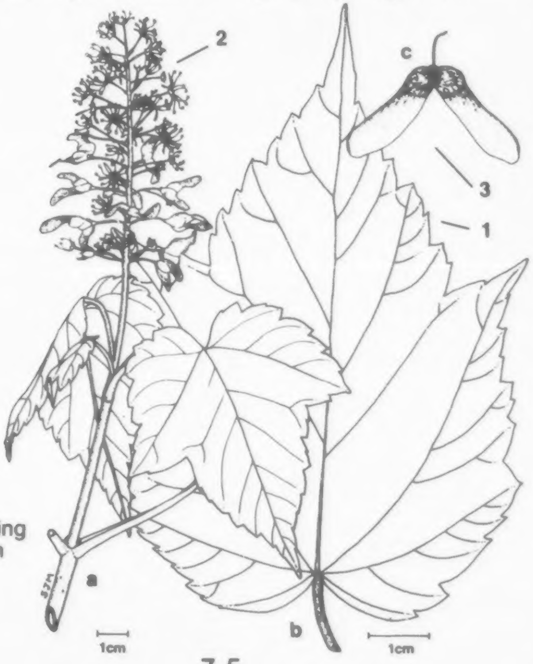
a. stem
b. leaf
c. fruit

Acer spicatum
Mountain Maple

2

form: Shrub or small tree. Twigs green to reddish and downy at the tips. Buds with 2 scales, elongate, downy, green.
leaves: Opposite, 6-13 cm long, petioled, green and coarse-textured above, downy beneath. **1.** Blade divided into 3 main lobes, tips pointed, center lobe triangular, margins coarse-toothed.
flowers: Greenish, numerous **2**. in erect, elongate, terminal clusters, appearing after the leaves.
fruit: A pair of winged samaras, red or yellow becoming brown, in short-stalked clusters. **3.** Angle between the spreading wings wide.





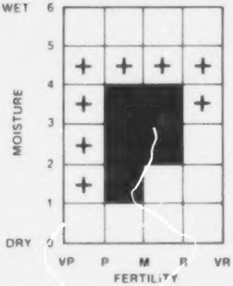
a. flowering branch
b. leaf
c. fruit

Alnus crispa
Mountain Alder

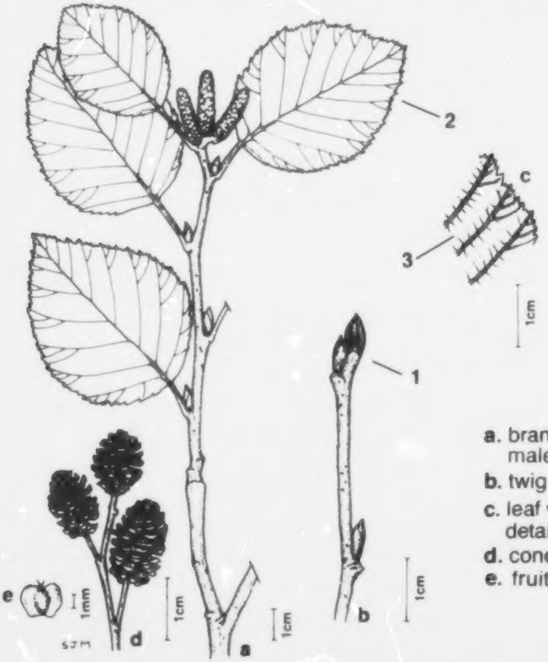
form: Shrub to 3 m tall. Young branches smooth to hairy, somewhat sticky, **1.** buds sessile, pointed.

leaves: Alternate, simple, petioled, **2.** blade ovate to broad-elliptic, 3-8 cm long, base rounded or cordate, tip pointed, margins finely toothed. Veins in 7-9 pairs, hairy, **3.** the small cross-veins not meeting.

flowers: In catkins, emerging with the leaves. Female catkins small, developing from lateral buds, male catkins elongate, terminal, without bud scales.



fruit: Small broad-winged nutlets in woody cones.



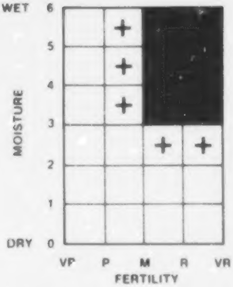
a. branch with male catkin
b. twig
c. leaf venation detail
d. cones
e. fruit

Alnus rugosa
Speckled Alder

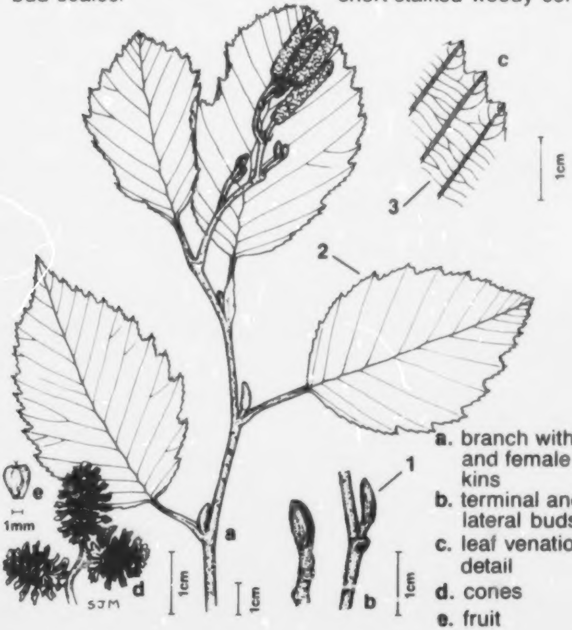
form: Shrub to 3.5 m tall. Twigs mostly smooth, **1.** buds stalked, blunt-tipped.

leaves: Alternate, simple, petioled, **2.** blade elliptic or ovate, to 10 cm long, base rounded, tip pointed, margins finely toothed, often jagged or wavy. Veins in 10 or more pairs, hairy, **3.** small cross-veins joined in a ladder-like pattern.

flowers: In terminal catkins, emerging before the leaves. Female catkins small, ovoid, on same branch as the elongate male catkins, all without bud scales.



fruit: Small, narrow or barely-winged nutlets in sessile or short-stalked woody cones.



a. branch with male and female catkins
b. terminal and lateral buds
c. leaf venation detail
d. cones
e. fruit

Cornus stolonifera
Red-Osier Dogwood

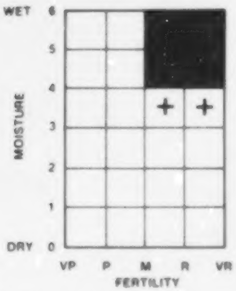
5

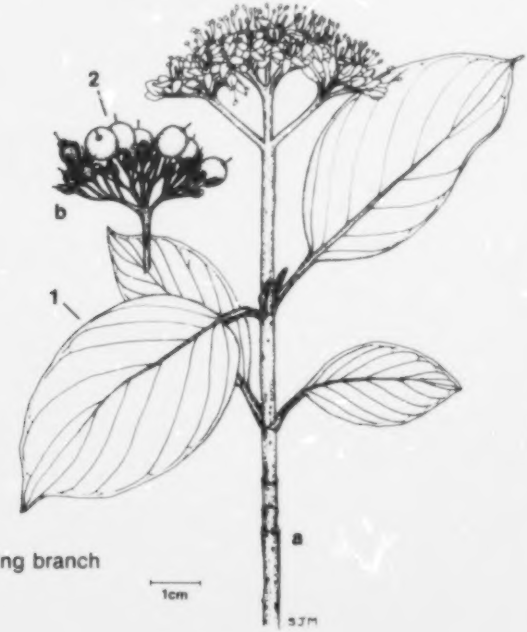
form: Shrub 1-3 m tall. Twigs red, smooth to downy at the tips, buds elongate, hairy; pith white.

leaves: Opposite, simple, petioled, smooth to somewhat hairy, 1. blade elliptic to ovate, 5-10 cm long, paler beneath, with 5-7 pairs of parallel, incurved veins, base rounded, tip pointed, margins entire.

flowers: White, small, many, in terminal, flat to slightly domed clusters. Petals 4, pointed.

fruit: 2. White berry-like drupes, 7-9 mm wide, with persistent, black styles at the tip. Inedible.



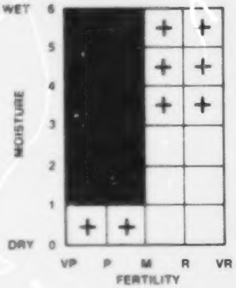


a. flowering branch

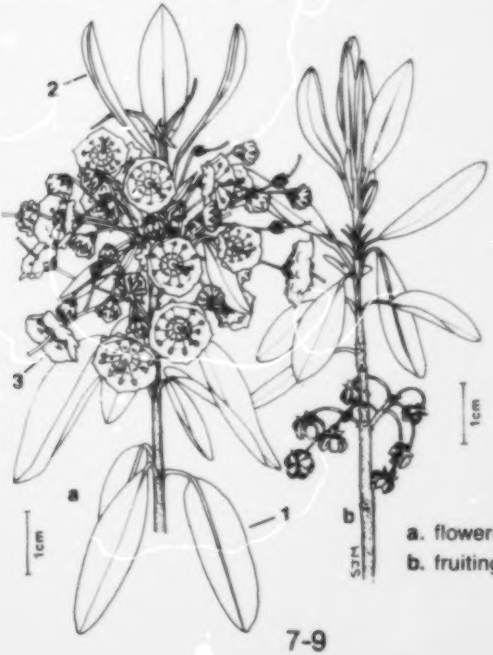
b. fruits

Kalmia angustifolia
Sheep Laurel

form: Evergreen shrub to 1 m tall, stems smooth.
leaves: In whorls of 3, or opposite; simple, smooth and leathery, 2-5 cm long, petioled. Blade **1.** elliptic-oblong, green and shiny above, pale beneath, tip blunt to pointed, margins entire and curved under.
flowers: Pink, rarely white, many, clustered around the stem, **2.** with young, erect leaves above. **3.** Corolla round, bowl-shaped, to 1.3 cm wide, slightly 5-lobed; stamens 10, arched, with tips caught in small depressions in the corolla until released when touched.



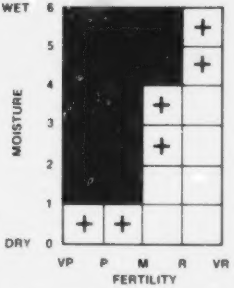
fruit: Small, dry, rounded capsules, pendant, splitting in 5 parts.



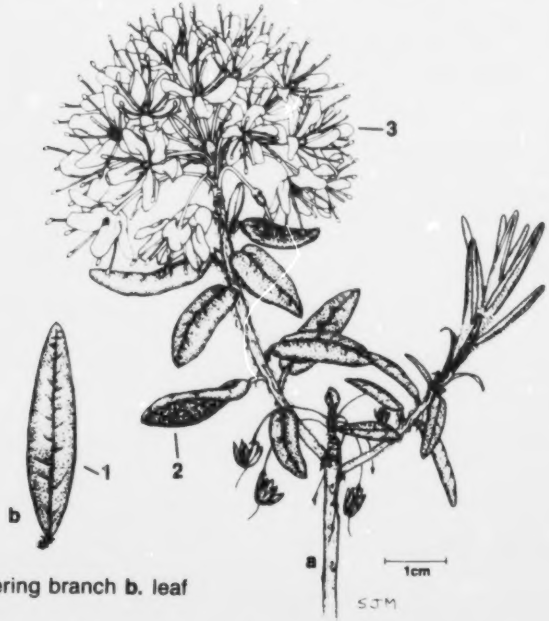
a. flowering branch
b. fruiting branch

Ledum groenlandicum
Labrador Tea

form: Evergreen shrub to 1 m tall, young twigs densely hairy, flower bud large, terminal.
leaves: Alternate, simple, to 5 cm long, short-petioled. Blade **1**. oblong-elliptic, dull, dark green and leathery above, blunt-tipped, margins entire, strongly curved under, **2**. dense rust-colored wooly beneath; in young erect leaves, dense white-hairy.
flowers: **3**. White, many, in rounded, terminal clusters. Corolla deeply 5-lobed, spreading, about 1 cm wide; stamens 5-7, longer than the petals.



fruit: Dry, oblong capsules with persistent style, pendant, splitting into 5 parts from the base.



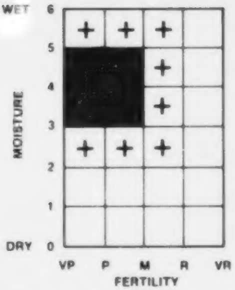
a. flowering branch **b**. leaf

Nemopanthus mucronata 8
Mountain Holly

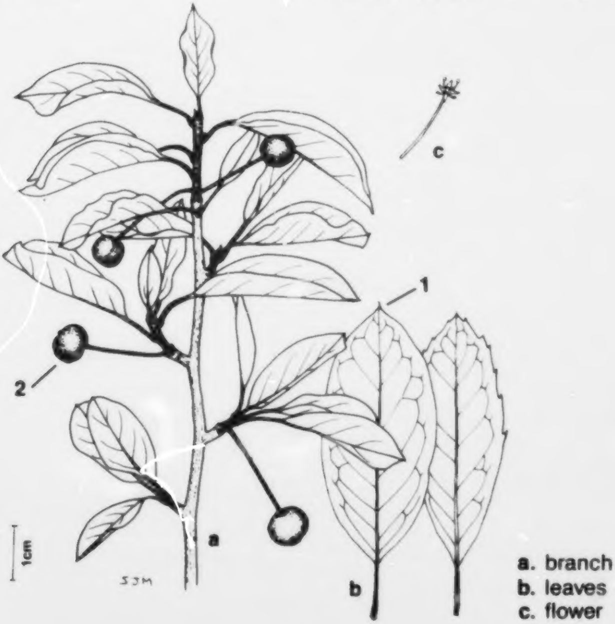
form: Shrub to 3 m tall. Twigs purplish-brown, smooth, buds short, with dark purplish scales. Bark ash-gray, distinctively mottled.

leaves: Alternate, simple, to 8 cm long, petiole purple. Blade elliptic to oblanceolate, smooth, thin, green above, paler beneath, tip pointed, **1.** with a short bristle, margins entire to rarely toothed. Fall leaves yellow.

flowers: Yellowish, small, long-stalked, solitary or few, axillary, male and female flowers separate. Flowers parts in 4's or 5's.

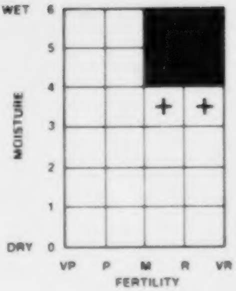


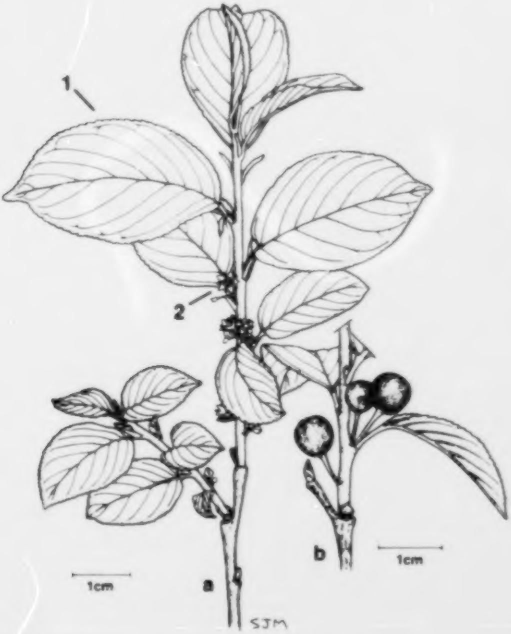
fruit: 2. Red to bright magenta, round, berry-like drupes, to 7 mm long, on long spreading stalks. Inedible.



Rhamnus alnifolia
Alder-leaved Buckthorn

form: Low shrub to 8 dm tall. Young stems green, smooth.
leaves: Alternate, simple, short-petioled. 1. Blade ovate or elliptic, 2-8 cm long, base rounded, tip pointed, margins finely blunt-toothed.
flowers: 2. Greenish, small, 1-3 in axillary clusters, petals none; sepal lobes 5, pointed; stamens 5.
fruit: A berry-like drupe, green becoming red, then black. Inedible.

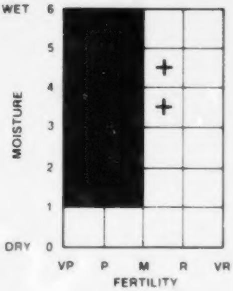




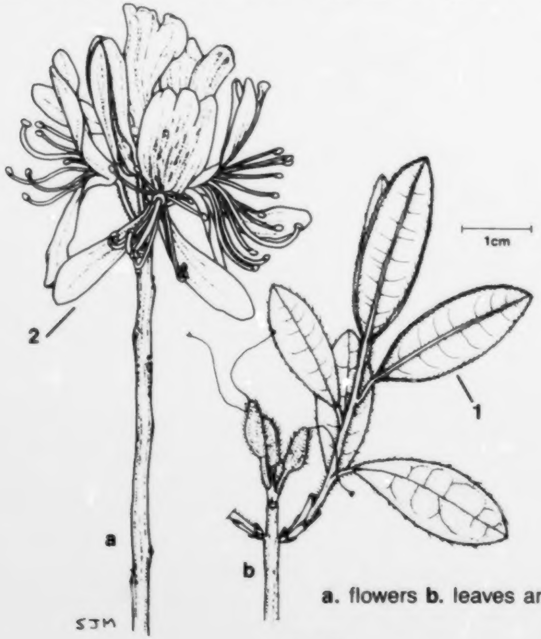
a. branch b. fruits

Rhododendron canadense
Rhodora

form: Shrub to 1 m tall. Twigs smooth, young stems hairy.
leaves: Alternate, simple, short-petioled. **1.** Blade elliptic to oblanceolate, 2-5 cm long, hairy, gray- or bluish-green above, paler beneath, tip blunt or pointed, margins entire, curved under.
flowers: Lavender to purplish-pink, 2-3 cm wide, several, clustered at the stem tip, appearing before the leaves. **2.** Corolla deeply divided into 2 lower oblong lobes and one broad, shallowly 3-lobed, erect upper segment; stamens 10.



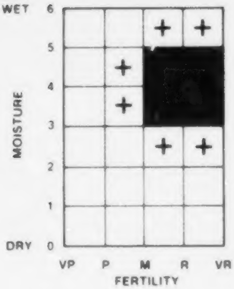
fruit: Dry, ovoid, hairy, erect capsules tipped with the long, persistent styles.

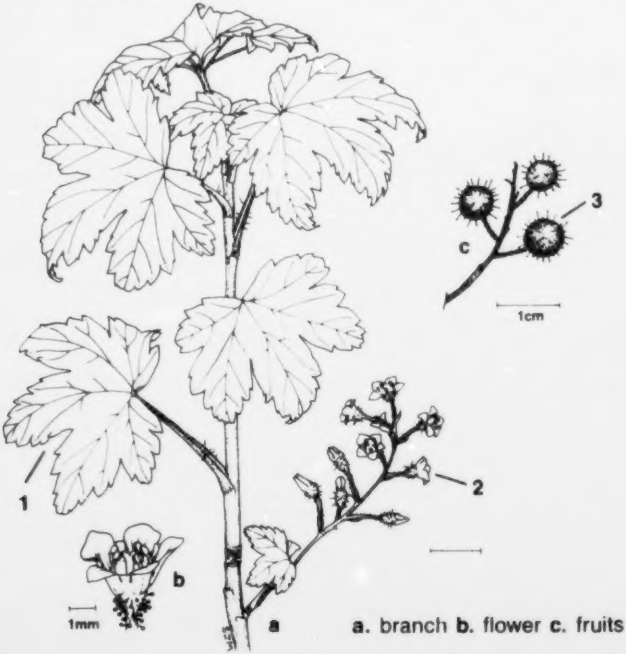


a. flowers **b.** leaves and fruits

Ribes glandulosum
Skunk Currant

form: Straggling or erect shrub to 1 m tall. Stems smooth. Bruised plant has skunk odor.
leaves: Alternate, simple, petiole with few soft hairs near base. **1.** Leaf palmately lobed to middle of the blade, lobes 5-7, ovate, margins coarsely double-toothed, base cordate.
flowers: White to pinkish, **2.** several in erect clusters, 2.5-5 cm long. Flower stalks glandular-hairy.
fruit: **3.** Dark red, glandular-bristly, round berries in spreading clusters. Edible.





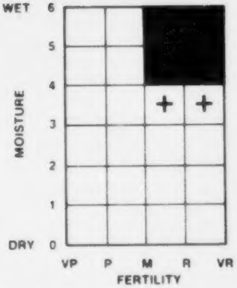
a. branch b. flower c. fruits

Ribes hirtellum 12
Smooth Gooseberry

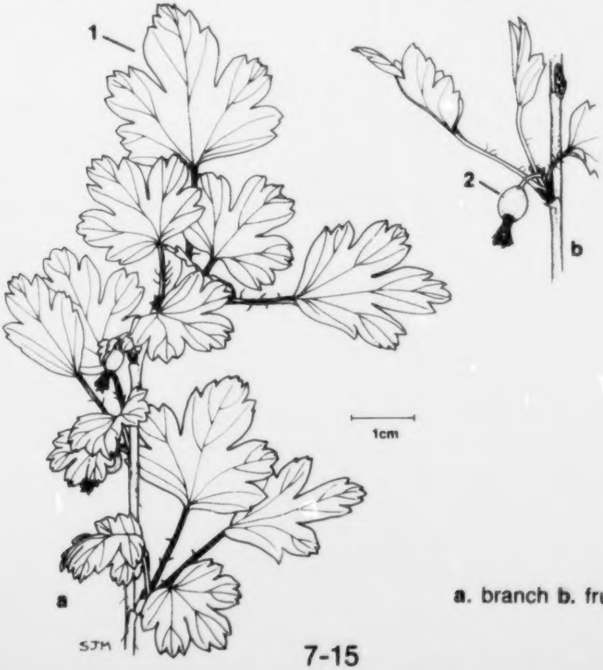
form: Straggling or erect shrub to 1 m tall. Stems with a few thorns.

leaves: Alternate, simple, petiole with scattered long hairs. **1.** Leaf palmately lobed to about middle of the blade, lobes 3-5, oblong to rounded, margins toothed, base wedge-shaped to flattened, blade somewhat hairy beneath.

flowers: Green to purplish, solitary or few, pendant, axillary. Flower stalks smooth. Sepals narrow, bent back; petals small; stamens longer than the petals.



fruit: Purplish, smooth, round berries, **2.** solitary in axils of upper leaves. Edible.



a. branch **b.** fruit

13

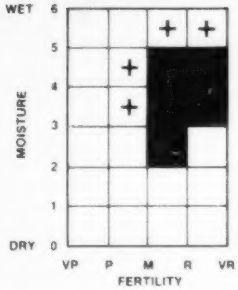
Ribes lacustre
Bristly Black Currant

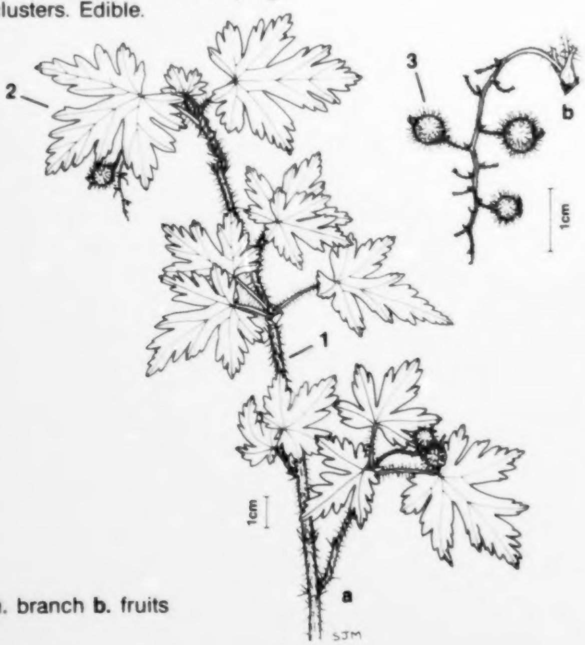
form: Erect shrub to 1.5 m tall. **1.** Stem densely covered with bristles and spines.

leaves: Alternate, simple, petiole very hairy, glandular. Leaf palmately lobed to more than middle of the blade, lobes 5-7, usually 5, oblong, **2.** center lobe widest at the middle, margins deeply toothed, base cordate.

flowers: Green to purplish, several in drooping clusters to 2.5 cm long. Flower stalks glandular hairy.

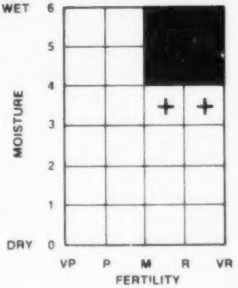
fruit: 3. Purplish-black, bristly, round berries in drooping clusters. Edible.



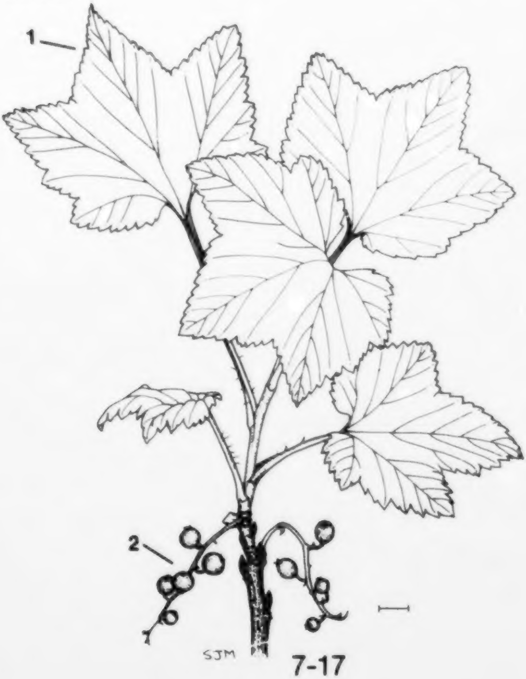


a. branch **b.** fruits

Ribes triste
Swamp Red Currant



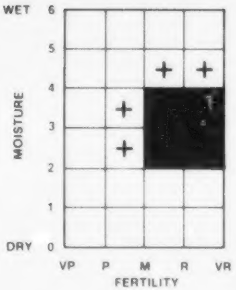
form: Straggling or erect shrub to 1 m tall. Stems smooth.
leaves: Alternate, simple, petiole with few soft hairs. Leaf palmately lobed to less than middle of the blade, lobes 3-5, 1. the 3 main lobes triangular, pointed, margins toothed, base somewhat cordate, blade usually hairy beneath.
flowers: Green to purplish, several in drooping clusters 2.5-9 cm long. Flower stalks glandular-hairy.
fruit: **2**. Red, smooth, round berries, in drooping clusters, Edible.

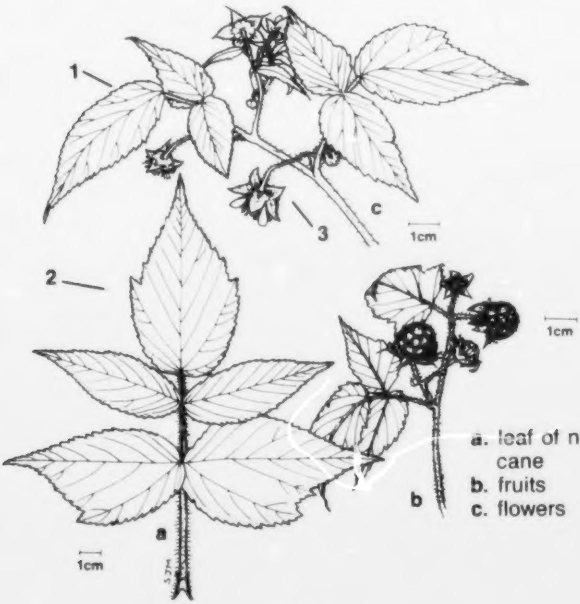


Rubus idaeus
Wild Raspberry

15

form: Biennial shrub with upright, prickly canes, not rooting at tips.
leaves: Alternate, pinnately compound, petiole bristly. **1.** Leaves of fruiting canes mostly with 3 leaflets, **2.** of new canes mostly 5. Leaflets lanceolate to ovate, 2-10 cm long, white beneath, tip pointed, margins sharply toothed.
flowers: White, drooping, in small axillary clusters. **3.** Flower stalks and sepals bristly; petals 5, narrow, erect; stamens and pistils many.
fruit: Red, a rounded berry-like cluster of druplets, separating together from the base when ripe. Edible.





a. leaf of new cane
b. fruits
c. flowers

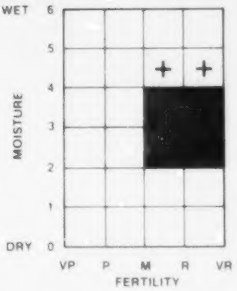
Sambucus pubens
Red Elderberry

16

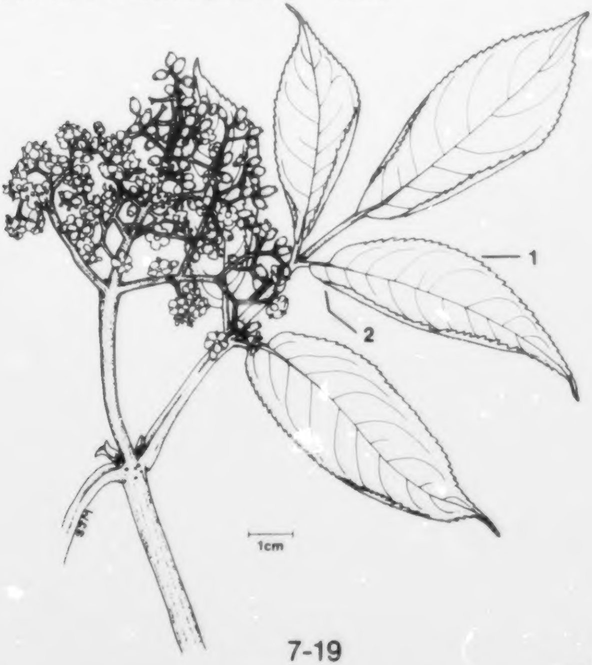
form: Shrub to 4 m tall. Stems downy when young, becoming smooth; pith brown.

leaves: Opposite, pinnately compound, petioled. **1**. Leaflets 5-7, lanceolate to oblong, 8-12 cm long, dark green above, paler and often downy beneath, tips long pointed, margins toothed. **2**. Base of leaflets oblique — the blade on one side of vein longer than the other side.

flowers: White to pinkish, small, numerous, in rounded to pyramid-shaped terminal clusters. Corolla with 5 rounded, reflexed lobes; stamens 5.

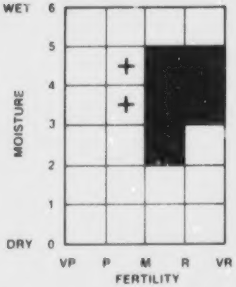


fruit: Bright red, small, berry-like drupes, numerous. Inedible.

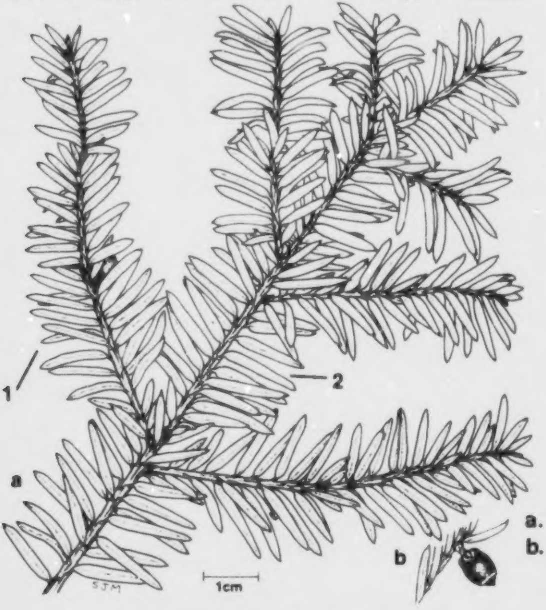


Taxus canadensis
Canadian Yew

17



form: Low evergreen shrub to 1.5 m tall; branches smooth.
leaves: Simple, **1.** linear, flat, sharp-pointed, 1-2 cm long and 1-2 mm wide, dark green, glossy above, yellowish-green below, midrib prominent. Leaves spirally arranged, petioles short, extending downward along the stem, and **2.** bent so leafy branches appear flattened.
flowers: Yellowish, small, inconspicuous, axillary on under-side of branch. Male and female flowers on separate plants.
fruit: Red, berry-like aril, ovoid, to 8 mm long; open at tip, revealing the enclosed, dark green, poisonous seed.
Note: May be confused with young Balsam Fir, which has blunt-tipped leaves.

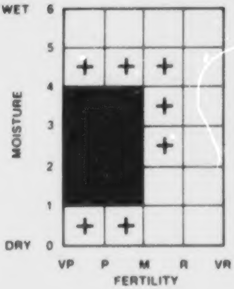


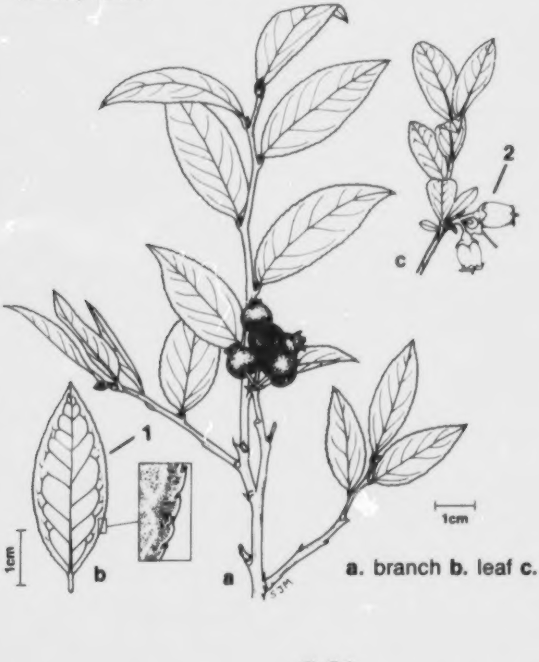
a. branch
b. fruit

Vaccinium angustifolium
Low Bush Blueberry

18

form: Low shrub to 3.5 dm tall.
leaves: Alternate, simple, short-petioled. 1. Blade elliptic or lanceolate, 1-3.5 cm long, dark green and glossy above, slightly paler beneath, tip pointed, margins finely toothed. Leaves red in fall.
flowers: White, pink-tinged, corolla urn-shaped, with 5 short lobes; appearing with leaves. **2.** Flowers and fruits several in clusters at branch ends.
fruit: Blue, round berries, 5-15 mm wide, often with a bloom. Edible, sweet.

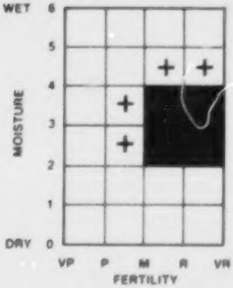


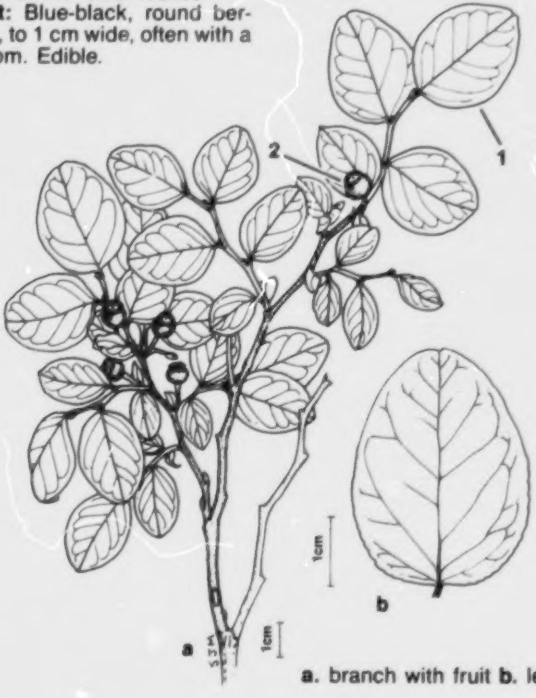


a. branch **b.** leaf **c.** flowers

Vaccinium ovalifolium
Oval-leaved Bilberry

form: Shrub to 1.5 m tall.
leaves: Alternate, simple, short-petioled. **1.** Blade elliptic to broad-ovate, to 4 cm long, smooth, bright green above, paler beneath, tip blunt to rounded, margins entire to shallowly toothed only below the middle.
flowers: Pinkish, corolla urn-shaped, narrowed at throat; appearing before leaves. **2.** Flowers and fruits solitary in axils of the lower leaves.
fruit: Blue-black, round berries, to 1 cm wide, often with a bloom. Edible.



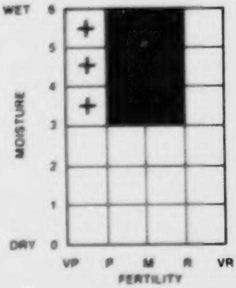


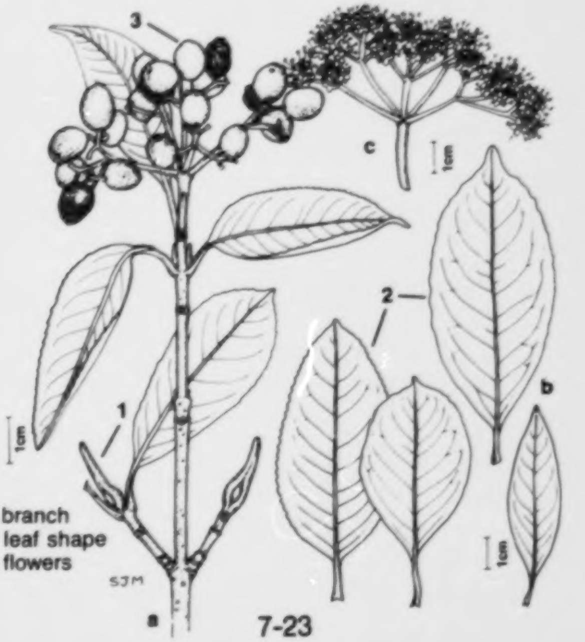
a. branch with fruit b. leaf

Viburnum cassinoides
Wild Raisin

20

form: Shrub to 4 m tall. **1.** Buds long, with 2 rusty-colored, rough scales.
leaves: Opposite, simple, to 15 cm long, petioled. **2.** Leaf shape variable: blade lanceolate, elliptic to obovate, leathery, dark green and glossy above, often with a dull bloom, paler beneath and with tiny rusty-colored scales, base rounded to wedge-shaped, tip blunt to prolonged or pointed, margins entire, wavy or toothed.
flowers: White, many, in large, flattened, terminal clusters.
fruit: **3.** White, becoming red, then bluish-black, wrinkled when mature. Ovoid, berry-like drupes. Edible.

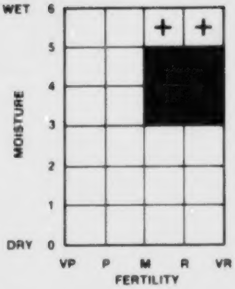




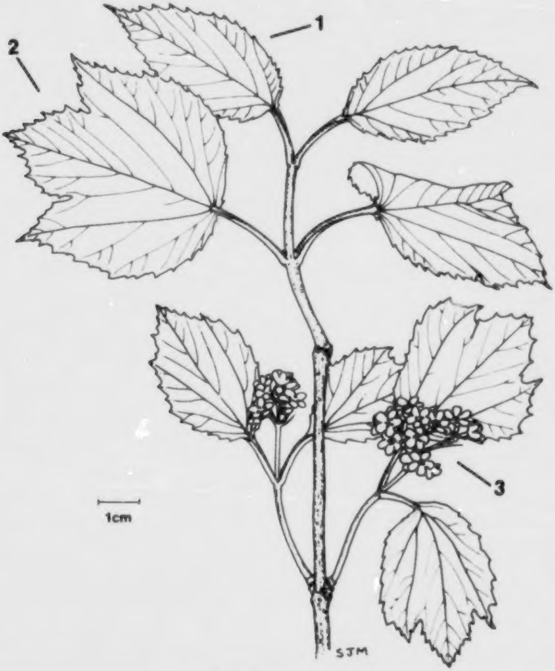
a. branch
b. leaf shape
c. flowers

Viburnum edule
Squashberry

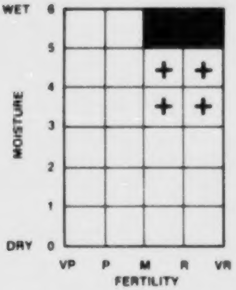
form: Shrub to 2 m tall. Terminal bud present, bud scales 2, dark red.
leaves: Opposite, simple, to 8 cm long, petioled, blade smooth, margins sharply toothed. **1**. Upper leaf pair elliptic to ovate, pointed; **2**. lower leaf pairs broad, 3-lobed, palmately veined, tips pointed.
flowers: White, several, **3**. in small, paired clusters, terminal on lower side branches. Flowers all fertile and the same size. Corolla of 5, small, rounded lobes.



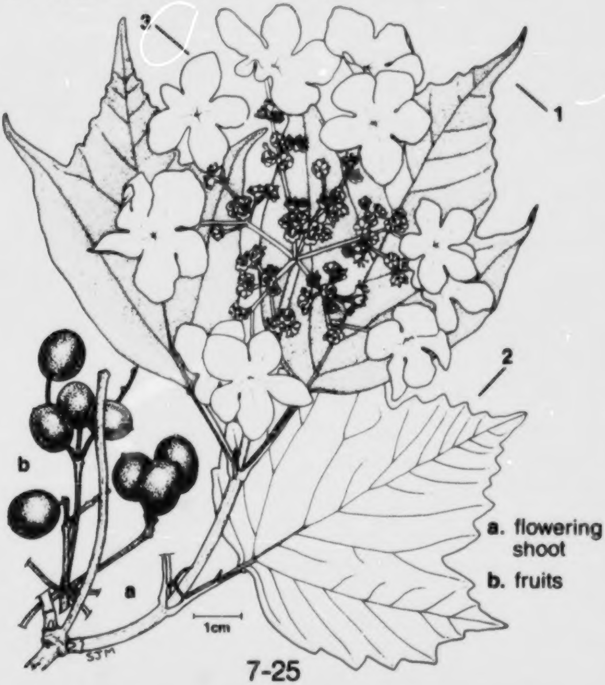
fruit: Red, ovoid, berry-like drupes. Edible.



Viburnum trilobum 22
Highbush-Cranberry

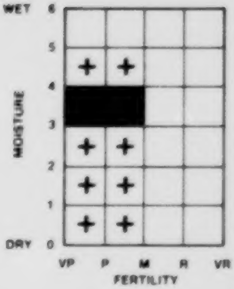


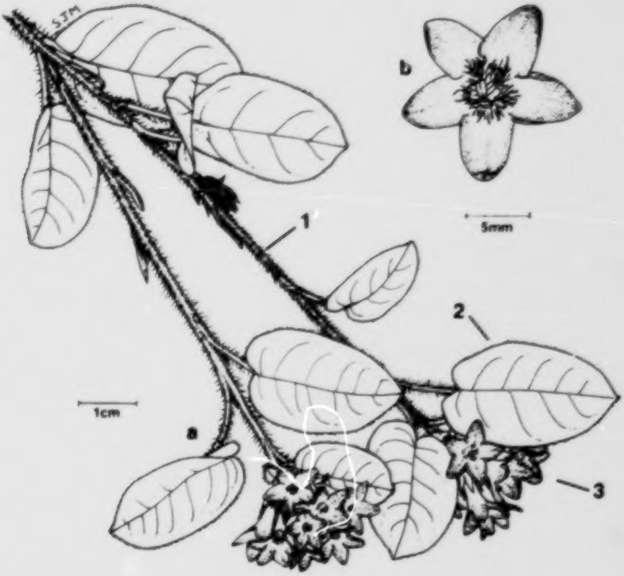
form: Shrub to 4 m tall. Terminal bud absent, twig ending in a long-thin stalk; lateral buds 2-scaled.
leaves: Opposite, simple, to 10 cm long, petioled. Blade 3-lobed, palmately veined. **1.** Terminal leaf pair with long-pointed lobes, margins entire to slightly blunt-toothed; **2.** lower leaf pairs broader, with shorter, less pointed lobes, margins coarse-toothed.
flowers: White, many, in a flat-topped cluster, terminal. **3.** Marginal flowers sterile, corollas enlarged, flat, 5-lobed; fertile flowers small, round-lobed.
fruit: Red, ovoid berry-like drupes. Edible.



Epigaea repens Mayflower or Trailing Arbutus

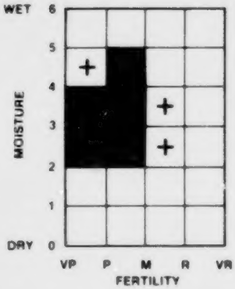
form: Low, trailing, evergreen dwarf-shrub. **1.** Stem hairy.
leaves: Alternate, simple, to 7 cm long, petioles hairy. Blade **2.** oval to oblong, leathery, somewhat glossy, but rough-textured above, base cordate, tip blunt to pointed, margins entire, hairy.
flowers: **3.** Pink to white, fragrant, several in terminal clusters. Corolla tubular, to 1.5 cm long, with 5 spreading lobes, white-hairy at the center.
fruit: Dry, rounded capsules, surrounded by pointed bracts.



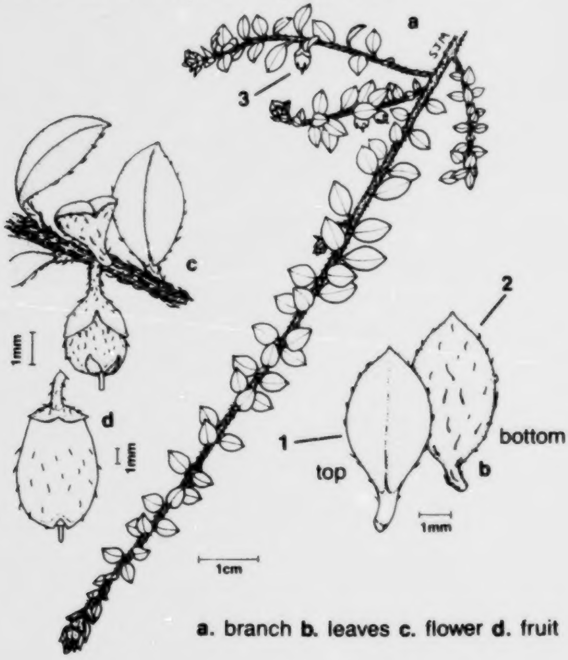


a. flowering branch b. flower

Gaultheria hispidula
Creeping Snowberry



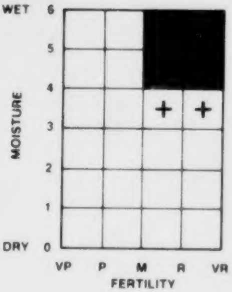
form: Low, trailing, evergreen dwarf-shrub. Stems hairy, barely woody.
leaves: Alternate, simple, small, to 10 mm long, short-petioled. Blade **1.** broad-elliptic to ovate, dark green, glossy and smooth above, **2.** paler with brown hairs beneath, tip pointed, margins entire.
flowers: White, with scattered hairs, small and **3.** pendant, bell-shaped, few, axillary. Flower parts in 4's.
fruit: White, with short scattered hairs, ovoid, berry-like, 5-10 mm long. Edible, wintergreen taste.

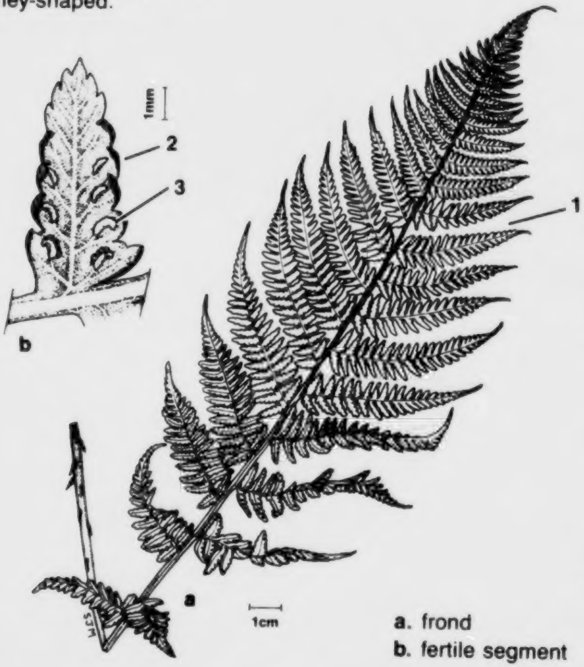


a. branch **b.** leaves **c.** flower **d.** fruit

Athyrium filix-femina 25
Lady Fern

form: Perennial fern, growing in tufts from thick, creeping rhizomes.
fronds: Bipinnate, to 9 dm tall. Stalk short, scaly at base. Blade smooth, lanceolate-elliptic, widest near the middle, 10-35 cm wide. **1.** Pinnae alternate on main axis, ascending, lower pairs slightly reduced. **2.** Pinnae deeply cut into oblong, lobed or toothed segments.
sori: Near end of short, forked veins, **3.** indusia curved, attached along the side, or kidney-shaped.

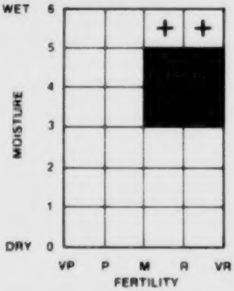




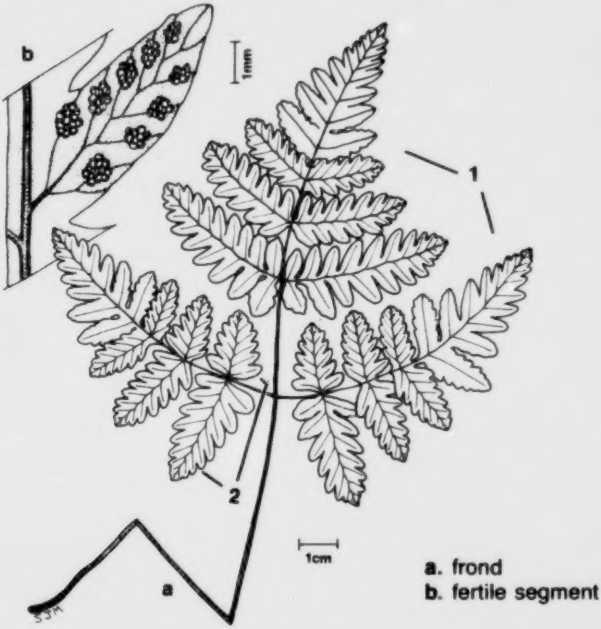
a. frond
b. fertile segment

Dryopteris disjuncta
Oak Fern

26



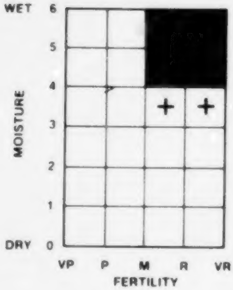
form: Perennial fern; thin creeping rhizomes bearing scattered fronds.
fronds: Bipinnate, to 5 dm tall. Stalk longer than blade, smooth, wiry. Blade broadly triangular, **1.** divided into 3 nearly equal, stalked parts. Pinnae opposite, lower ones deeply cut into oblong, blunt segments. Upper pinnae quickly decreasing in size and amount of division. **2.** Pinnae of 2 lateral divisions unequal, the lower of each pair larger. Veins mostly simple.
sori: Small, dot-like clusters near margins, indusia none.
synonym: *Gymnocarpium dryopteris* (L.) Newm.

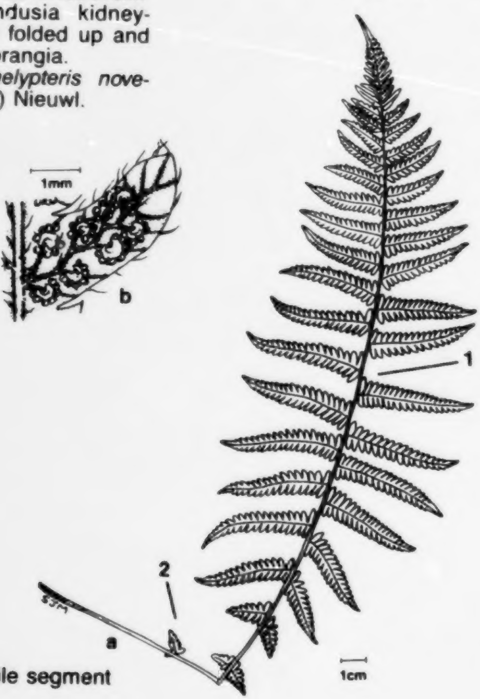


a. frond
b. fertile segment

Dryopteris noveboracensis New York Fern 27

form: Perennial fern; somewhat tufted from slender creeping rhizomes.
fronds: Pinnate, deeply lobed, to 9 dm tall. Stalk short, scaly at base. Blade light green, elliptic, widest at the middle, to 15 cm wide, tapering at both ends. Pinnae **1.** alternate on main axis, **2.** lower pairs greatly reduced. Pinnae deeply cut into oblong, entire segments. Veins and margins hairy.
sori: Dot-like, near ends of simple veins. Indusia kidney-shaped, often folded up and hidden by sporangia.
synonym: *Thelypteris noveboracensis* (L.) Nieuwl.



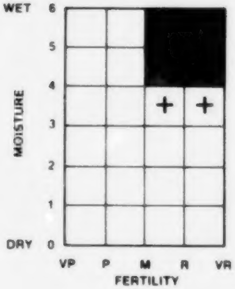


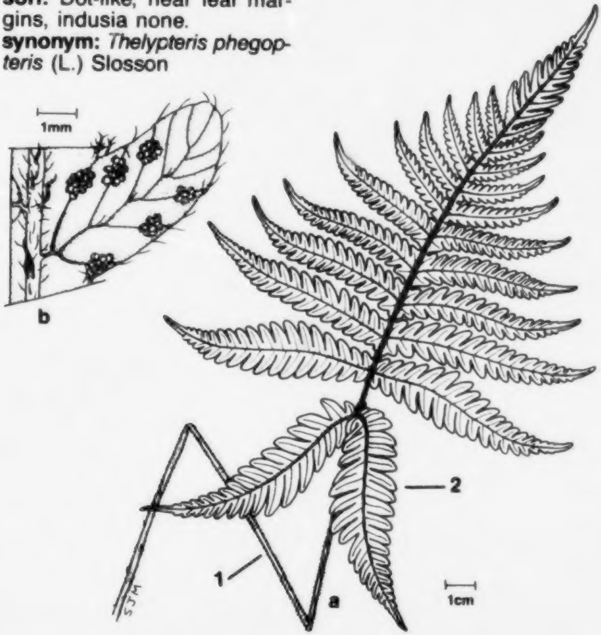
a. frond **b.** fertile segment

Dryopteris phegopteris Long Beech-Fern

28

form: Perennial fern; slender creeping rhizome bearing scattered fronds.
fronds: Pinnate, deeply lobed, to 5 dm tall. Stalk longer than blade, 1. scaly and hairy. Blade triangular, pinnae mostly opposite, deeply cut into oblong, blunt, entire segments. 2. Lowest pair of pinnae drooping, pointed forward, widest at the middle, distinctly separate from the upper pinnae. Margins and veins hairy.
sori: Dot-like, near leaf margins, indusia none.
synonym: *Thelypteris phegopteris* (L.) Slosson



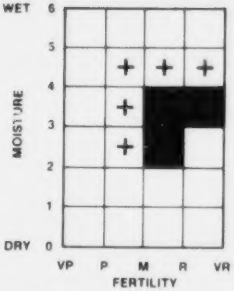


a. frond b. fertile segment

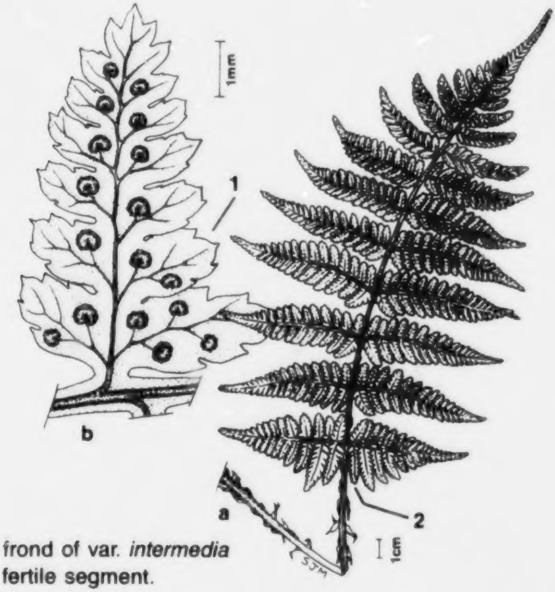
Dryopteris spinulosa Spinulose Wood Fern

29 30 31

form: Perennial fern; fronds clustered from thick, creeping to near-erect rhizomes.
frond: Bi- to tri-pinnate, to 1 m. tall. Stalk shorter than blade, scaly. Blade lanceolate to triangular. Pinnae opposite or nearly so, **1.** segments ovate to lanceolate, cut into several oblong lobes with narrow pointed teeth. **2.** Lowest pair of pinnae with unequal segments.
sori: Dot-like, near ends of branched veins, indusia kidney-shaped.
synonym: *Dryopteris austriaca* (Jacq.) Woynar.



Note: The 3 varieties described intergrade due to hybridization.



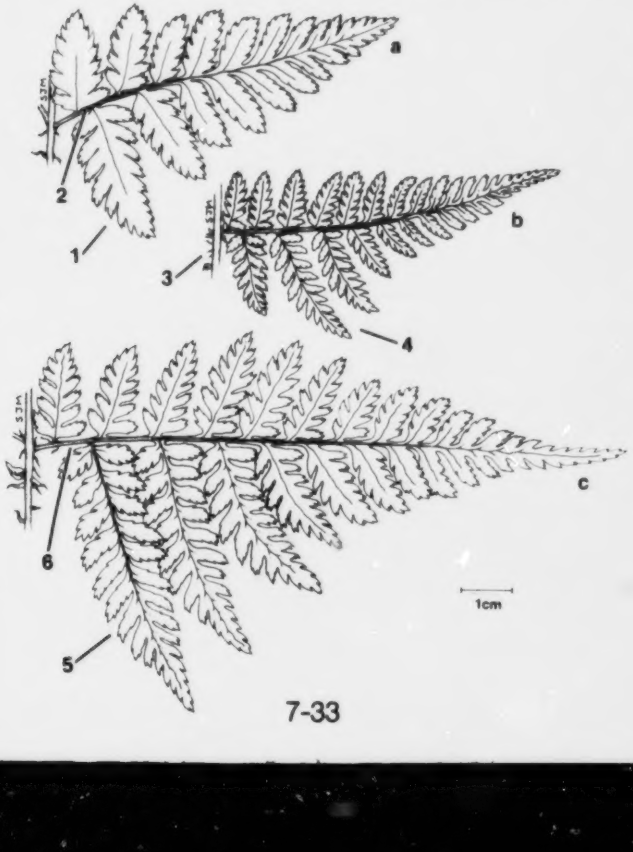
a. frond of var. *intermedia*
b. fertile segment.

Dryopteris spinulosa varieties: 29 30 31

a. var. ***typicum*** (O.F. Müll.) Watt
Spinulose Wood Fern (29)
The least dissected variety. Blade evergreen, narrow-triangular, bipinnate, smooth. **1.** First lower pinnule closest to stem longer than others; twice as long as, **2.** and nearly opposite, to less than 4 mm from, the first upper pinnule.

b. var. ***intermedia***(Muhl.)Underw.
Evergreen Wood Fern (31)
Blade evergreen, narrow-triangular, tripinnate, **3.** axis glandular. **4.** Second lower pinnule closest to stem longer than the first.

c. var. ***americana*** (Fisch.) Fern.
Mountain Wood Fern (30)
The largest variety. Blade not evergreen, broadly triangular, tripinnate, smooth. **5.** First lower pinnule closest to stem longer than others; nearly 3 to 4 times as long as, **6.** and 5-20 mm from, the upper pinnule.



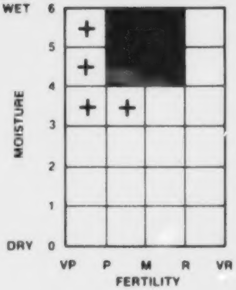
Osmunda cinnamomea
Cinnamon Fern

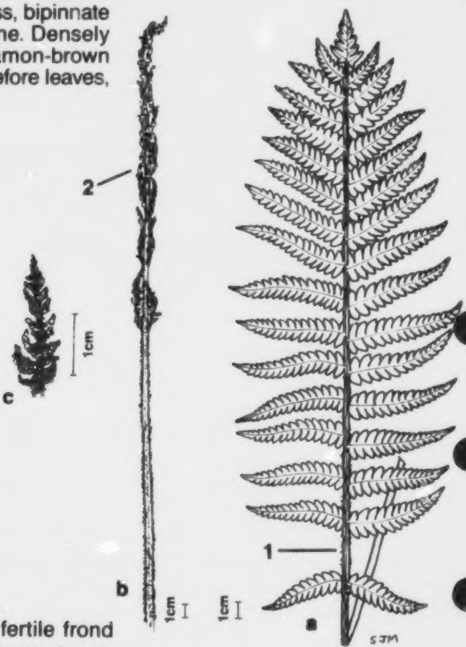
32

form: Large, perennial fern; fronds clustered from thick rhizomes. Fertile and sterile fronds different.

sterile fronds: Pinnate, deeply lobed, to 1.5 m tall. **1.** Stalks and young fronds with cinnamon-brown hairs. Blade oblong to oblanceolate. Pinnae alternate to nearly opposite, hairy at base; deeply cut into oblong, blunt, entire segments, Veins forked.

fertile fronds: Sporangia round, numerous, **2.** in clusters on narrow, bladeless, bipinnate fronds; indusia none. Densely covered with cinnamon-brown hairs. Appearing before leaves, soon wilting.



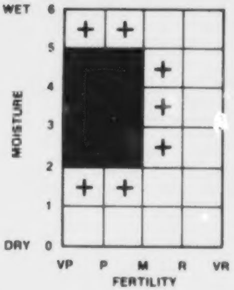


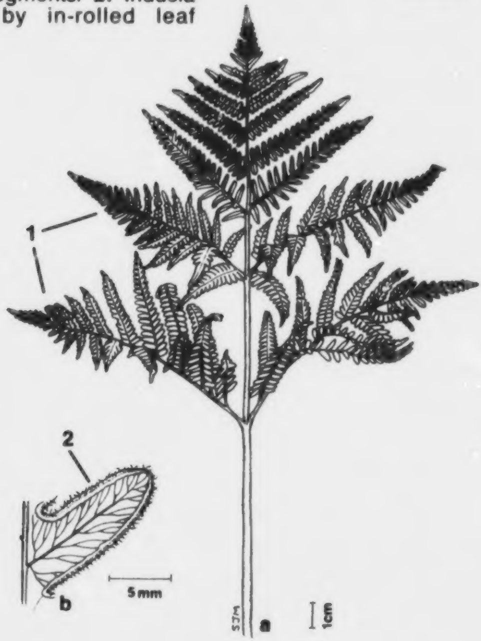
a. sterile frond **b.** fertile frond
c. one branch of fertile frond

Pteridium aquilinum
Bracken Fern

33

form: Large, perennial fern; growing in colonies from creeping rhizomes.
fronds: Tripinnate, to 1.5 m tall. Stalk mostly smooth. Blade broad-triangular, pinnae opposite or nearly so. 1. Lower 1-2 pairs of pinnae the largest, tripinnate, more divided than the upper pinnae. Segments narrow, oblong, blunt, margins in-rolled. Veins forked.
sori: Linear, along the margins of leaf segments. 2. Indusia formed by in-rolled leaf margins.



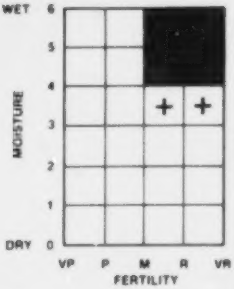


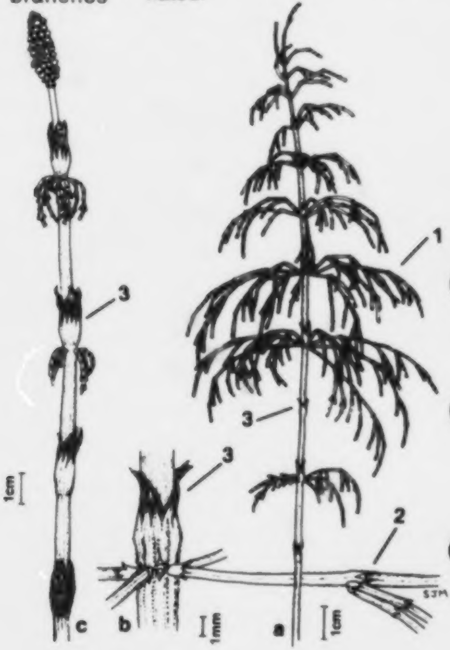
a. frond **b.** fertile segment

Equisetum sylvaticum
Woodland Horsetail

34

form: Perennial horsetail from deep, creeping rhizomes.
sterile stems: Stems and branches green, stems slender, hollow, ridged, to 6 dm [illegible]. 1. Branches whorled, numerous, drooping to spreading, 2. with several pairs of branchlets. Stem leaves reduced, 3. sheath-like, green below, divided into 3-4 brown, triangular lobes.
fertile stems: Spores in cones, terminal on stout stems, flesh-colored, becoming green when cone withers, with few whorls of undeveloped branches above. Leaf sheaths long, inflated.



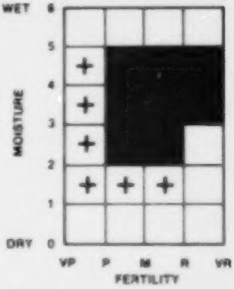


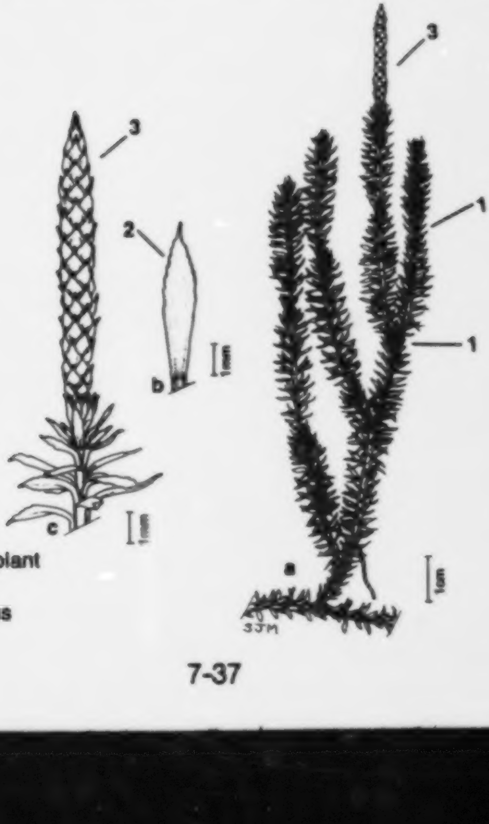
a. sterile stem
b. branch and leaf sheath
c. fertile stem

Lycopodium annotinum
Bristly or Stiff Clubmoss

35

form: Perennial, evergreen clubmoss. Stems creeping, growing in humus.
branches: Ascending, to 3 dm tall, simple or forked; 1. Each year's growth indicated by narrowing of stem, with a zone of smaller leaves.
leaves: Whorled, 2. stiff, narrow-elliptic to oblanceolate, to 11 mm long, bristle-tipped, margins slightly toothed. Leaves spreading to reflexed at base.
sporangia: Borne in a yellowish, 3. elongate strobilus, sessile at end of a leafy branch; bracts ovate, bristle-tipped.



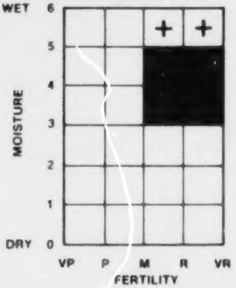


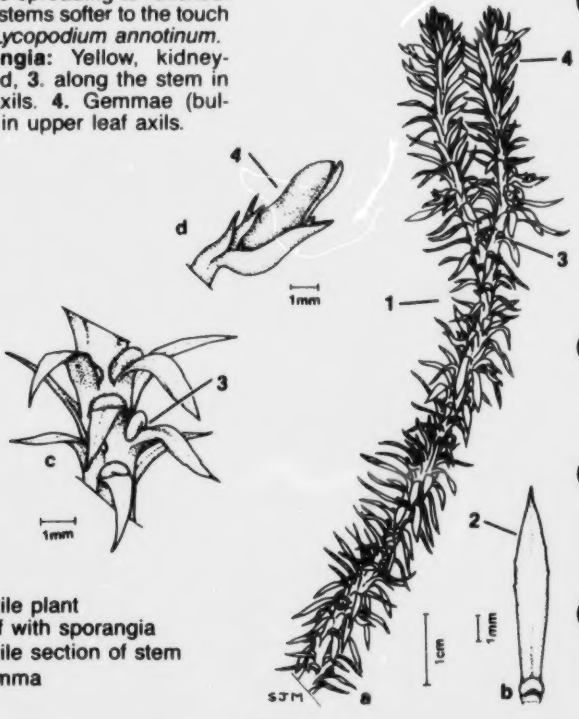
a. fertile plant
b. leaf
c. strobilus

Lycopodium lucidulum
Shining Clubmoss

36

form: Perennial, evergreen clubmoss; horizontal stems spreading.
branches: Ascending, to 2.5 dm tall, forked. **1.** Each year's growth indicated by narrowing of stem with a zone of smaller leaves.
leaves: Whorled, **2.** dark green, glossy, oblanceolate, to 15 mm long, widest above the middle, bristle-tipped, margins slightly toothed to entire. Leaves spreading to reflexed. Leafy stems softer to the touch than *Lycopodium annotinum.*
sporangia: Yellow, kidney-shaped, **3.** along the stem in leaf axils. **4.** Gemmae (bulblets) in upper leaf axils.

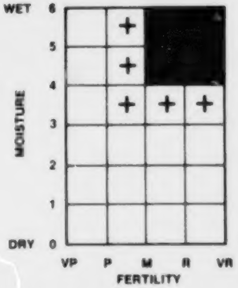


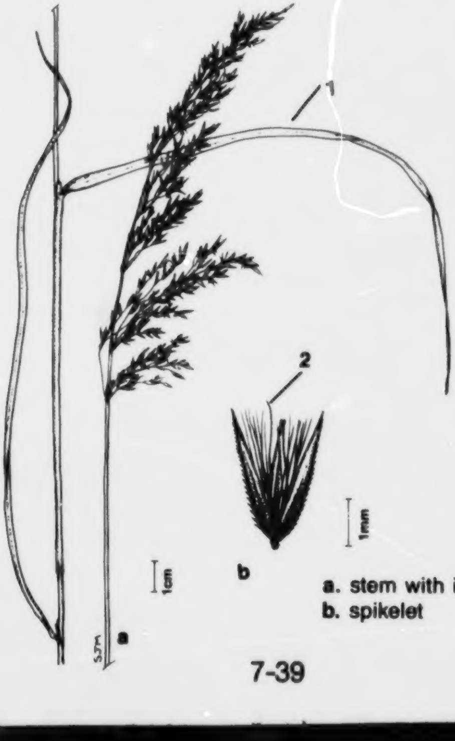


a. fertile plant
b. leaf with sporangia
c. fertile section of stem
d. gemma

Calamagrostis canadensis 37
Blue-joint

form: Tall, perennial grass from creeping rhizomes. Flowering stems erect, 0.5-1.5 m tall.
leaves: Long and narrow, **1.** blade flat, bluish-green, dull, 4-8 mm wide, rough to the touch. Stem leaves 4-7.
inflorescence: Open to dense, nodding panicle with several spikelets along each branch.
spikelets: 1-flowered, purplish, 2-6 mm long. Glumes long-pointed, keeled, rough, nearly equal, persistent after the fruit drops. **2.** Long awn attached to middle of the lemma, many long bristles attached at base.

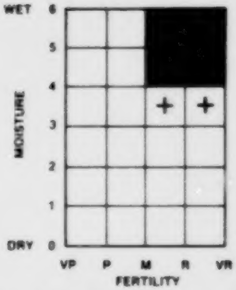


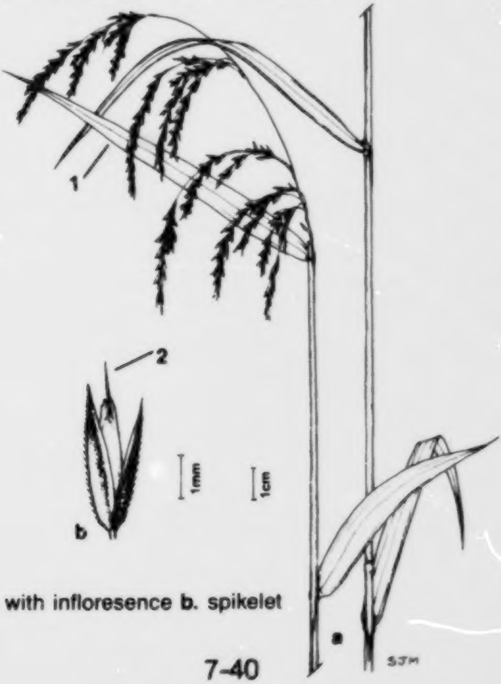


a. stem with inflorescence
b. spikelet

Cinna latifolia
Wood Reedgrass

form: Tall, perennial grass, Flowering stems erect, 0.2-1.5 m tall.
leaves: Long and narrow, 1. blades flat, green, to 15 mm wide, rough to the touch. Stem leaves 3-7, 1. upper leaves spreading, not drooping.
inflorescence: Open, nodding, slender panicle with several spikelets along each branch.
spikelets: 1-flowered, green to purplish, 2.0-4.5 mm long. Glumes long-pointed, keeled, rough, falling with the fruit, inner glume slightly longer than outer. 2. Lemma with a short awn attached at tip. Basal bristles none.

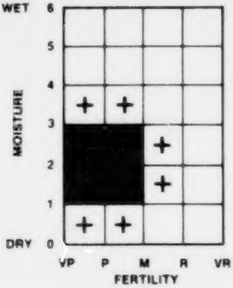


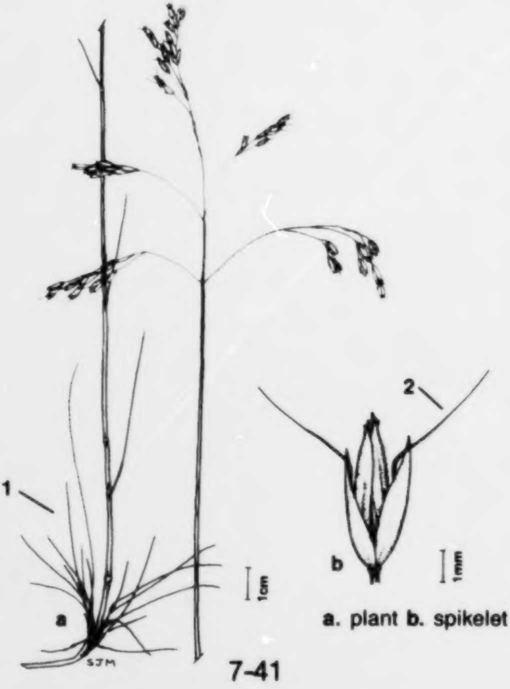


a. stem with infloresence b. spikelet

Deschampsia flexuosa 39
Hair Grass

form: Perennial, tufted grass, 0.3-1.0 m tall.
leaves: **1.** Mostly basal, short, narrow, 1-2 mm wide, margins rolled inward.
inflorescence: Slender, open panicle with several spikelets at branch ends.
spikelets: 2-flowered, bronze to purplish, 4-6 mm long. Glumes pale, smooth, persistent after the fruits drop. Inner glume slightly longer than the outer. **2.** Awn bent below the middle, 1-3 mm longer than the lemma, attached near the base; many short bristles at base, hidden by the glumes.



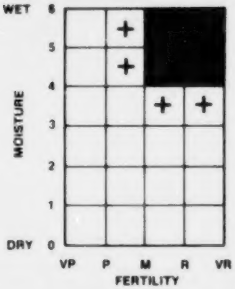


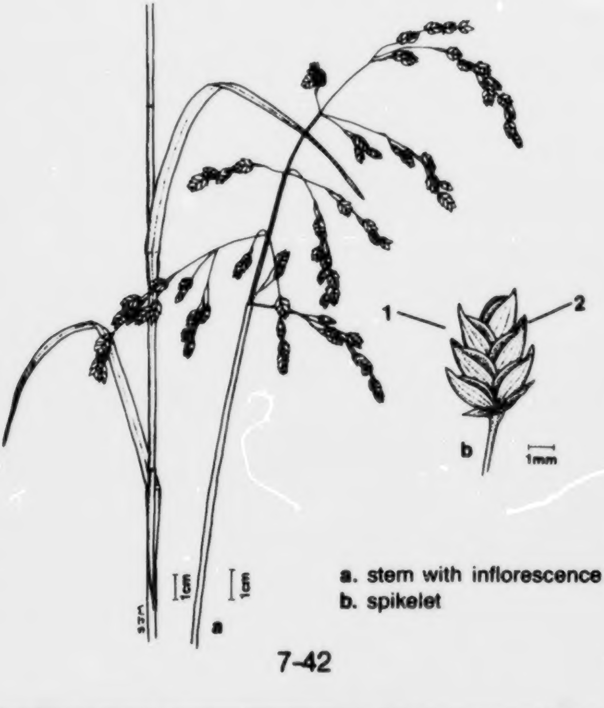
a. plant b. spikelet

Glyceria canadensis
Rattlesnake Grass

40

form: Perennial grass with 1-few erect stems, to 1 m tall. **leaves:** Linear, blades flat, 2-10 mm wide, somewhat rough to the touch. Stem leaves 3-5. **inflorescence:** Open, nodding panicle with spikelets toward the branch ends. **spikelets:** **1.** 4-10 flowered, 2-ranked, light brown, 4-8 mm long. Glumes small, rough, persistent after the fruits drop, the inner glume larger. **2.** Lemmas broadly ovate, 7-lined, margins thin, not covering the rounded paleas. Tip of lemma 0.5-1.0 mm longer than the palea.



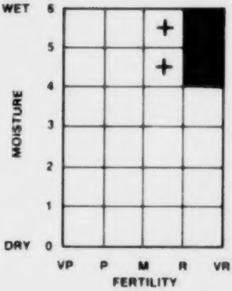


a. stem with inflorescence
b. spikelet

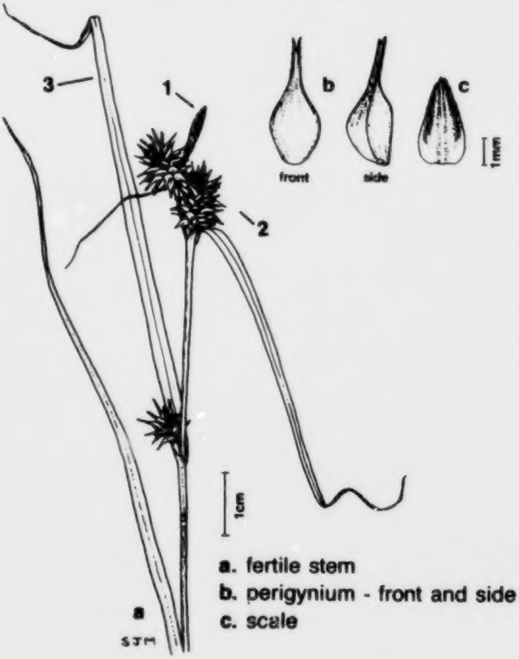
Carex flava

41 /

form: Perennial sedge in dense clumps, 1-8 dm tall.
leaves: Long and narrow, 2-6 mm wide, shorter than the slender flowering stems.
flowers: 1. Male flowers in one nearly sessile, terminal spike, held above the fruiting heads. 2. Female flowers in 2-6 rounded heads. Pistil surrounded by a persistent sac-like perigynium. 3. Bracts leaf-like, longer than the fruiting heads.
fruit: Perigynium light green, or yellowish, ovate inflated, narrowed to a long, slender beak.



Scales ovate-lanceolate, brownish. Achene 3-sided.

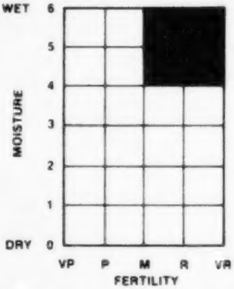


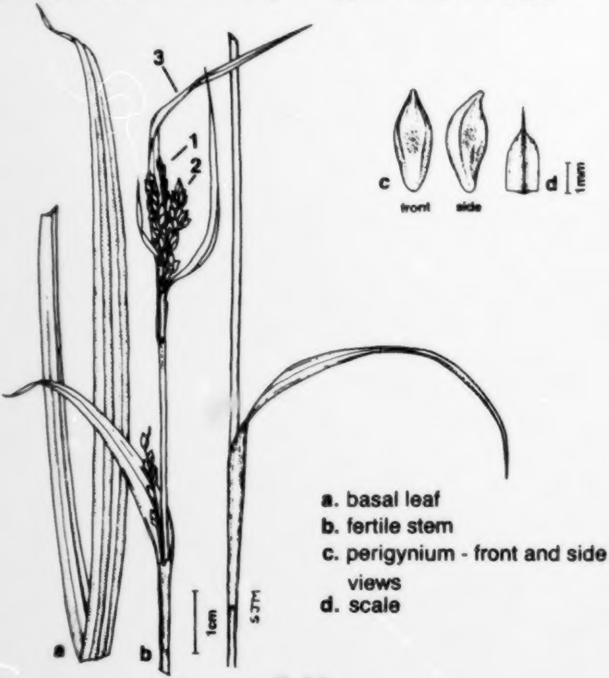
a. fertile stem
b. perigynium - front and side views
c. scale

Carex leptonervia

42

form: Perennial sedge in loose clumps, 2-6 dm tall.
leaves: Long and narrow, 3-10 mm wide. Stem leaves narrower.
flowers: 1. Male flowers in one small spike, shorter to barely longer than the fruiting heads. 2. Female flowers in narrow, cylindrical spikes. Pistil surrounded by a persistent sac-like perigynium. 3. Leaf-like bracts longer than the fruiting heads.
fruit: Perigynium obovoid, short-beaked, 2.5-4 mm long. Scales pale, oblong, bristle-tipped. Achene 3-sided.



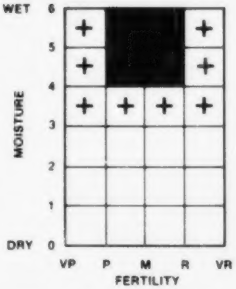


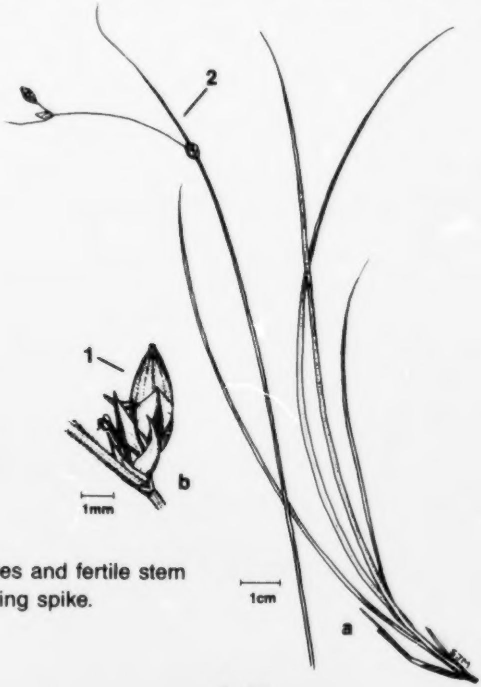
a. basal leaf
b. fertile stem
c. perigynium - front and side views
d. scale

Carex trisperma

43

form: Perennial sedge in loose to dense, low clumps. Fertile stems very slender, 2-7 dm long, longer than the leaves.
leaves: Linear, 0.2-2.0 mm wide.
flowers: Spikes 1-3, small; **1.** each with 1-5 female flowers and a few male flowers at the base. Pistil surrounded by a persistent sac-like perigynium. **2.** Lower spike subtended by a very long, narrow bract.
fruit: Perigynia ellipsoid, short-beaked, to 4 mm long. Scales pale, ovate. Achene 2-sided.

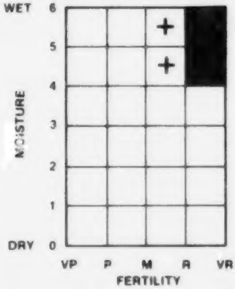


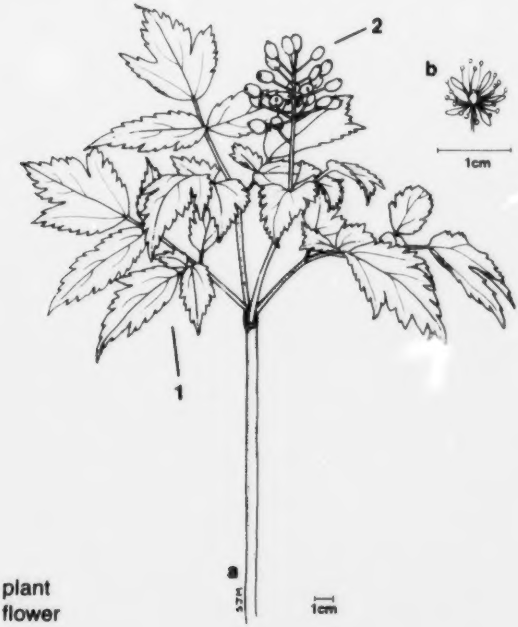


a. leaves and fertile stem
b. fruiting spike.

Actaea rubra
Red Baneberry

form: Perennial herb, 4-8 dm tall.
leaves: Alternate, **1.** large, compound, repeatedly divided, petioled. Leaflets ovate to lanceolate, sharply toothed and lobed.
flowers: White, small, numerous, in a terminal raceme. Petals 4-10, small, narrow; stamens white, numerous; pistil one.
fruit: Bright red or white, **2.** ovoid berries on slender stalks, fruit cluster 3-10 cm tall. Poisonous.

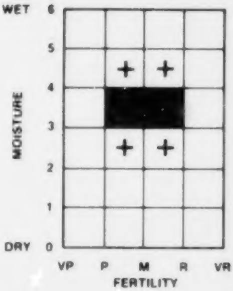




a. plant
b. flower

Aralia nudicaulis
Wild Sarsaparilla

45

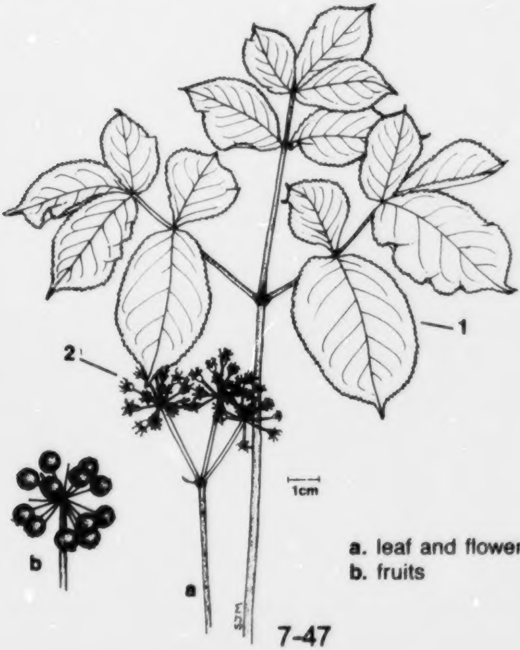


form: Perennial herb, 2-5 dm tall. Stem short, close to the ground, bearing 1 long-petioled leaf and 1 smooth, flowering stalk.

leaf: Single, basal, compound, repeatedly divided, usually with 5 pinnate leaflets on each of 3 divisions. Leaflets oblong-ovate to obovate, tips pointed, margins toothed. **1.** Lower leaflet, closest to the stem, about 2X larger than the opposite one.

flowers: Greenish-white, small, many, in 3-7 round, stalked clusters. **2.** Flower stalk shorter than, and often hidden by the leaf.

fruit: Bluish-black, round berries, 6-8 mm long. Inedible.



a. leaf and flowering stalk
b. fruits

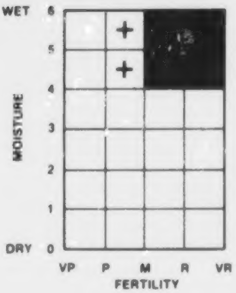
Aster puniceus
Purple-stemmed Aster

46

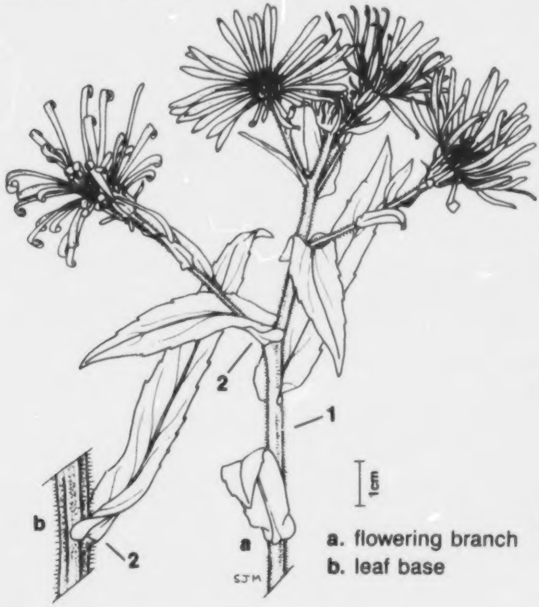
form: Perennial herb, to 2.5 m tall. **1.** Stem reddish-purple, hairy, simple to many-branched.

leaves: Alternate, simple, sessile, to 20 cm long and 1-4 cm wide. Blades narrow, lanceolate, rough-textured above, smooth below, to hairy on the veins, **2.** Base strongly clasping, tip long-pointed, margins coarsely toothed.

flowers: Blue-violet to lavender heads (rarely white), 2.5-4 cm wide, few to numerous in leafy, flat-topped clusters. Ray flowers long, narrow, 20-40, disk flowers yellow, numerous.



fruit: An achene, topped with bristles.

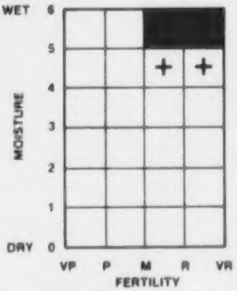


a. flowering branch
b. leaf base

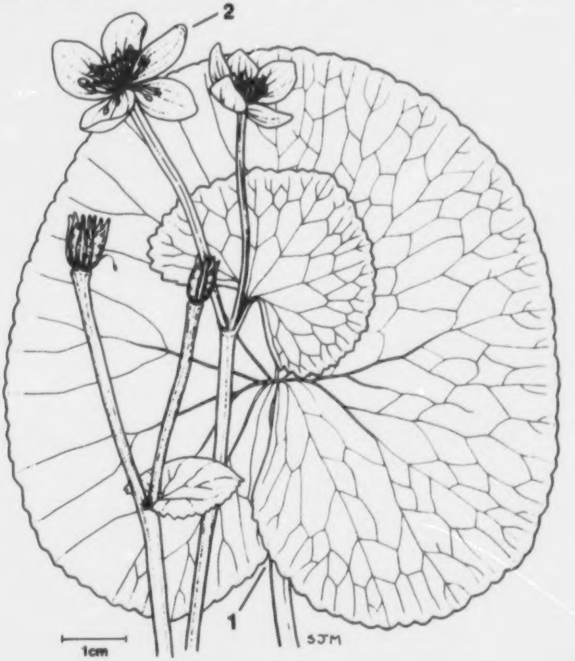
Caltha palustris
Marsh-Marigold

47

form: Perennial herb, to 1.5-6 dm tall. Stem hollow, smooth. **leaves:** Basal and alternate, simple, smooth. Blades round to kidney-shaped, cordate, margins blunt-toothed. 1. Basal leaves large, long-petioled, basal lobes overlapping; stem leaves short-petioled to sessile, smaller, more open at the base. **flowers:** 2. Deep yellow, 1.5-4 cm wide, few, terminal. 5-9 petal-like sepals, elliptic to obovate; petals none; stamens numerous, pistils 4-12.



fruit: Several beaked follicles, each 10-15 mm long.

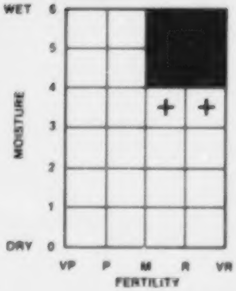


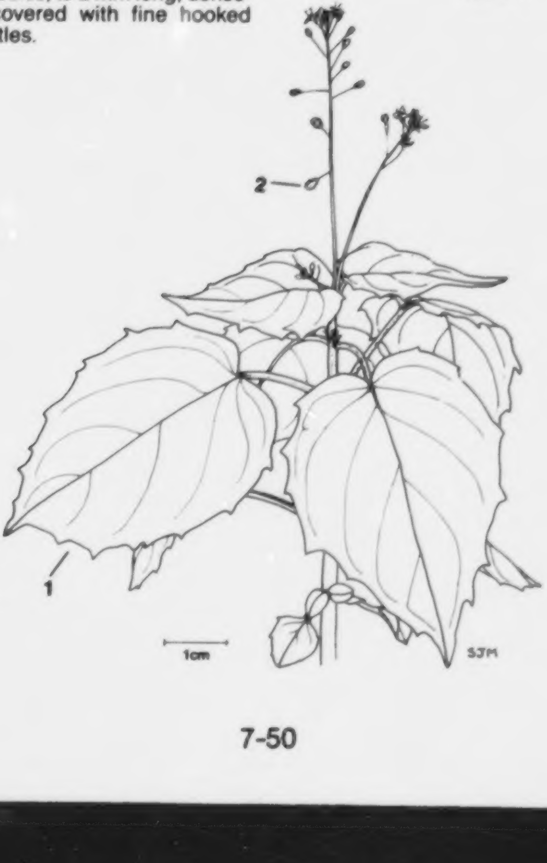
Circaea alpina

Dwarf Enchanter's Nightshade

48

form: Weak perennial herb, 1-3 dm tall.
leaves: Opposite, simple, long-petioled. **1.** Blade cordate-ovate to triangular-ovate, 1-6.5 cm long, tip pointed, margins coarsely toothed.
flowers: White, small, several to many, stalked, in elongate, terminal or axillary racemes. Petals 2, deeply lobed (appearing as 4); stamens 2.
fruit: Dry, **2.** ovoid to obovoid capsules, to 2 mm long, densely covered with fine hooked bristles.

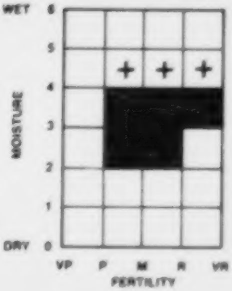


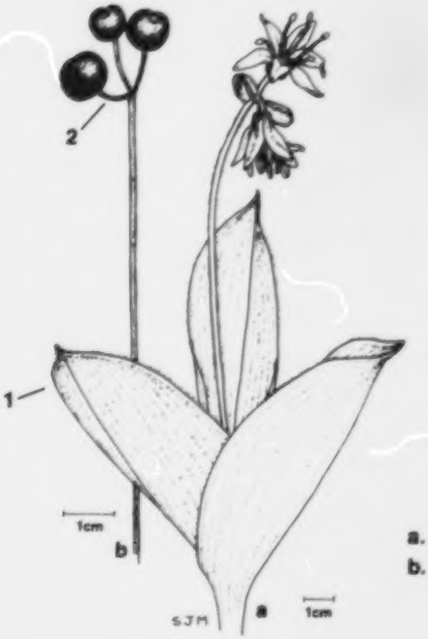


Clintonia borealis
Yellow Clintonia

49

form: Perennial herb, 1.5-4 dm tall.
leaves: Basal, usually 3, simple, 1-3 dm long. Blades elliptic, light green, **1.** glossy, tip pointed, margins entire and finely hairy.
flowers: Yellow to greenish, 3-8, bell-shaped, stalked, nodding, at top of a tall flower stalk. Sepals and petals alike, 6, narrow-oblong; stamens 6.
fruit: Blue to blackish, round berry, 0.7-1 cm wide, **2.** fruit stalks erect. Poisonous.

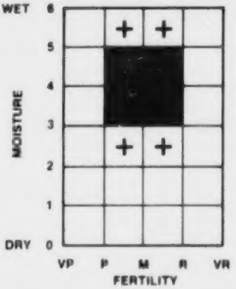




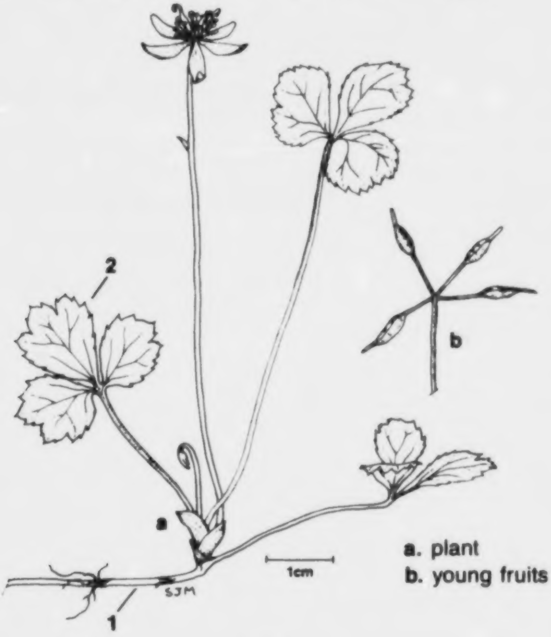
a. flowering plant
b. fruit

Coptis groenlandica
Goldthread

form: Low, perennial herb, **1.** from a thin, bright yellow rhizome, bitter to taste.
leaves: Basal, evergreen, long-petioled, compound, divided into 3 parts. **2.** Leaflets short-stalked, obovate, dark green and shiny, shallowly lobed, toothed, teeth bristle-tipped.
flowers: White, 1 to 1.5 cm wide, solitary on a slender stalk, 7-13 cm tall. Sepals 5-7, petal-like, elliptic-oblanceolate; petals 5-7, small, yellow, fleshy, modified into nectarines; stamens numerous, pistils 3-9.



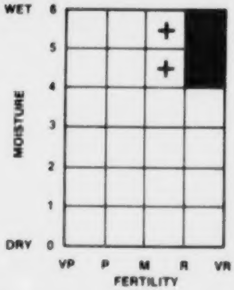
fruit: 3-9 divergent, beaked follicles, 8-13 mm long.

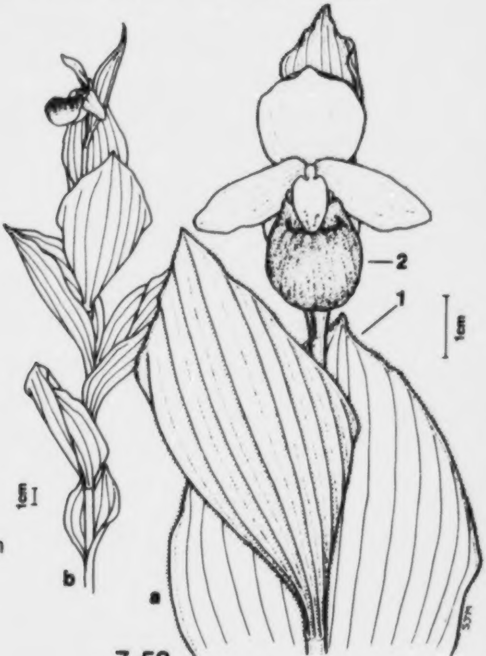


Cypripedium reginae Showy Lady-slipper

51

form: Large, perennial herb, 3-8 dm tall. Stem hairy.
leaves: Alternate, simple, sessile. **1.** Blade large, broadly ovate, hairy, parallel-veined, tip pointed, margins entire.
flowers: Pink and white, usually 1. **2.** Lower petal (lip) enlarged into an obovoid, inflated pouch, 3-5 cm long, bright or light pink, to white at the base, streaked with dark pink. Lateral petals white, oblong-lanceolate, blunt-tipped, spreading. Sepals white, the lower 2 united under the lip, upper sepal broad-ovate, arching. Column white, spotted with yellow, bent into the lip.
fruit: A dry capsule.



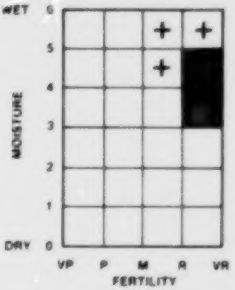


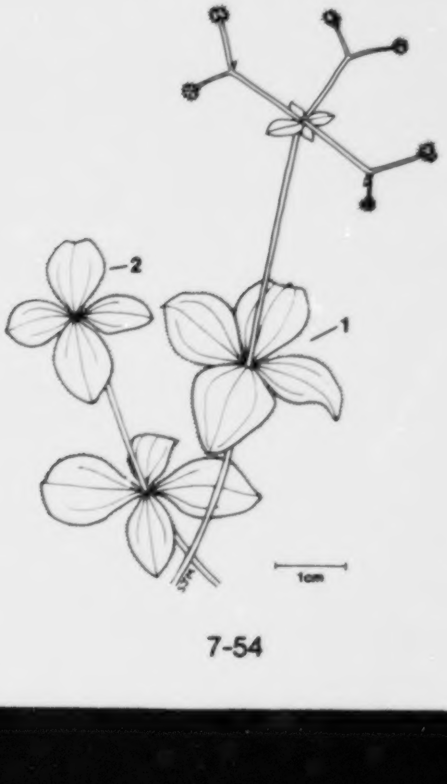
a. upper portion of plant
b. whole plant

Galium kamtschaticum

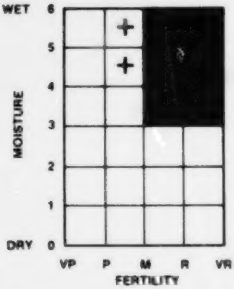
52

form: Weak-stemmed perennial. Stem square, smooth, 1-2 dm long, simple or forked.
leaves: **1.** In 2-4 whorls of 4, simple, sessile. **2.** Blades elliptic to obovate, 3-veined, tips pointed or rounded, and bristle-tipped, margins finely hairy. Leaves of upper whorl the largest, 1-3.5 cm long, to 2 cm wide.
flowers: Yellowish-white, tiny, stalked, on 1-3 terminal stems, each 1-3 flowered, or 3-forked. Flower parts in 3's or 4's.
fruit: A dry capsule, 1-1.5 mm long, of 2 rounded segments, covered with fine hooked bristles.





Galium triflorum
Sweet-scented Bedstraw

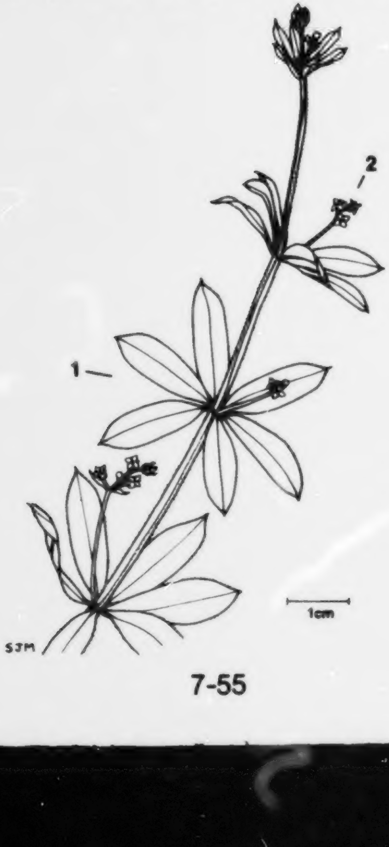


form: Trailing perennial, 2-10 dm long. Stem mostly simple, square, smooth or with short recurved bristles.

leaves: 1. In whorls of 6, simple, sessile. Blade elliptic to oblanceolate, 2-6 cm long, bristle-tipped, margins finely hairy.

flowers: Greenish-white, small, stalked, 2. in groups of 3's at the end of simple or 3-branched flower stalks, in terminal and axillary clusters. Flower parts in 4's.

fruit: A dry capsule, to 2 mm long, of 2 rounded segments, covered with hooked bristles.

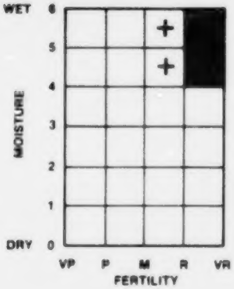


Geum rivale
Purple Avens

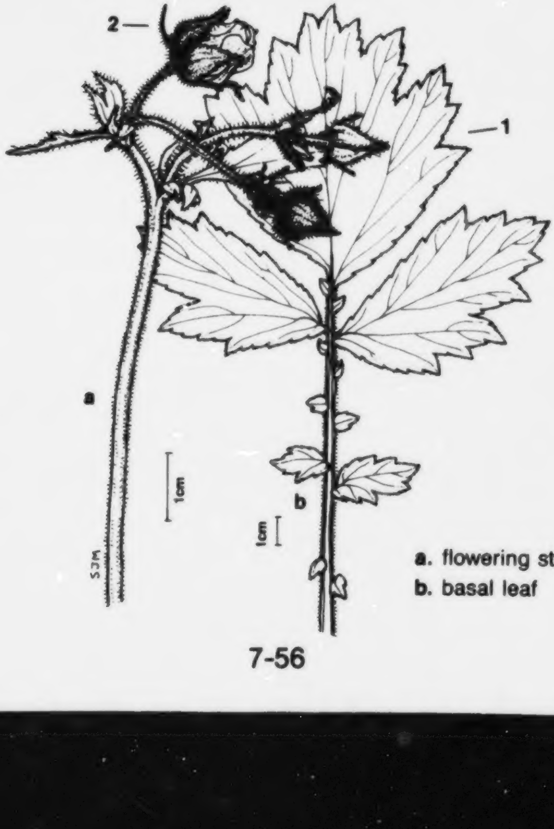
54

form: Perennial herb, 0.3-1.2 m tall. Stem unbranched, hairy. **leaves:** Basal and alternate, pinnate-compound, to 3 dm long, petioled. 1. Leaflets mainly 3-5, terminal leaflet obovate, all leaflets irregularly cut and toothed. Stem leaves sessile.

flowers: Dark red and yellow, 2. several, stalked, nodding, on top of a long hairy stem. Sepal lobes reddish-purple, pointed, hairy, 7-10 mm long; petals 5, yellow to salmon-colored, veined with pink or red, barely longer than the sepals. Stamens and pistils many.



fruit: An erect achene with a feathery tip.

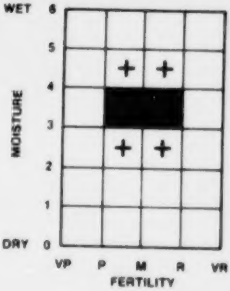


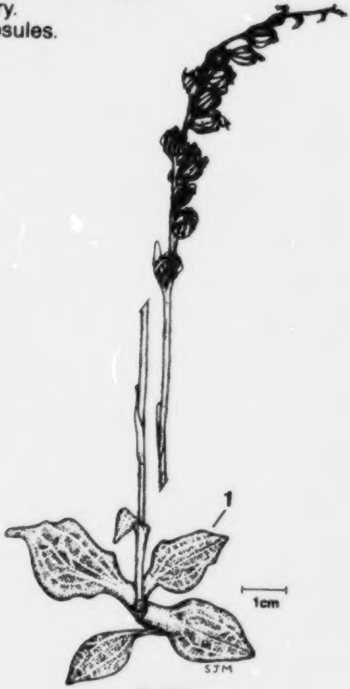
a. flowering stem

b. basal leaf

Goodyera repens 55
Dwarf Rattlesnake-Plantain

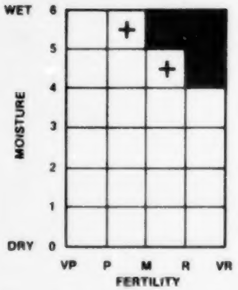
form: Low, evergreen, perennial herb. Flowering stem 1-3 dm tall, glandular-hairy.
leaves: Basal, ovate to elliptic, 1-3 cm long, 1. dark green, reticulate veins white, blade narrowing to base, tip blunt to pointed, margins entire.
flowers: White to greenish, small, many, in a 1-sided raceme, 3-6 cm long. Flowers 4-5 mm long, lower petal (lip) with a recurved tip; lateral sepals ovate, pointed; upper petals and sepal fused, hoodlike. Flower stalks and flowers glandular hairy.
fruit: Dry capsules.

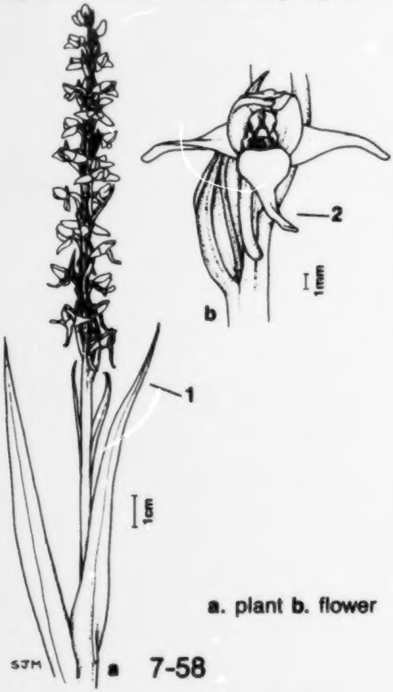




Habenaria dilatata
Scent-bottle
56

form: Smooth, perennial herb, 0.15 to 1 m tall.
leaves: Alternate, sheathing, simple, to 20 cm long and 0.5-2 cm wide. **1.** Blades narrow-lanceolate, tips very long-pointed, margins entire. Upper leaves smaller, graduating into bracts.
flowers: Snowy white, fragrant, many, spirally arranged and sessile on a terminal spike 1-3 dm tall. Flowers to 1 cm wide, **2.** lower petal (lip) wide at the base, narrowing to a blunt tip, spur as long as the lip. Lateral sepals spreading, upper petals bent forward and curved under the upper sepal. Ovary ridged.
fruit: Dry capsules.

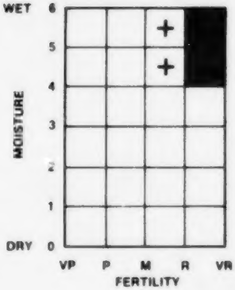


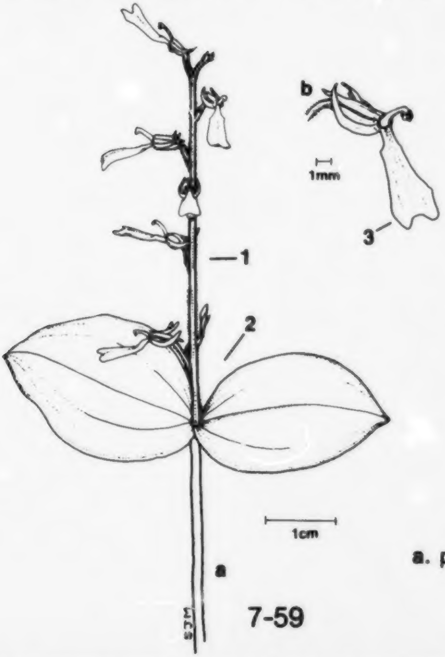


a. plant b. flower

Listera convallarioides 57
Broad-lipped Twayblade

form: Perennial herb, 0.7-3 dm tall. **1.** Stem above the leaves and flower stalk glandular-hairy.
leaves: Opposite, 2, sessile **2.** at or above middle of the stem. Blade broad-elliptic, pale green, glossy, 2-6.5 cm long, tip blunt to pointed, margins entire.
flowers: Translucent green, several, stalked, in an open raceme, 2-13 cm long. Lowest flower closer to leaves than the leaf length. Flowers 1-1.5 cm long, **3.** lower petal (lip) broad, notched at the end, narrowing to the base with a short, triangular tooth on each side. Sepals and upper petals alike, narrow, reflexed. Column slender, arched.
fruit: Dry capsules.

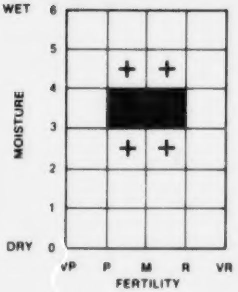




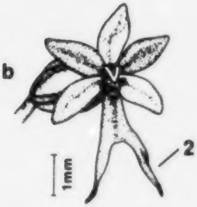
a. plant b. flower

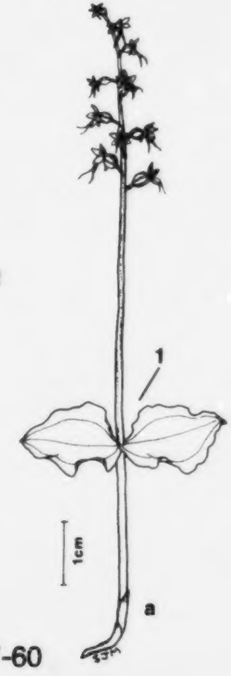
Listera cordata
Heartleaf Twayblade

form: Perennial herb, 1-2 dm tall. Stem smooth.
leaves: 1. Opposite, 2, sessile below middle of the stem. Blade broad-ovate, 1.5-3 cm long, base somewhat cordate to rounded, tip pointed, margins entire, flat or wavy.
flowers: Purplish-green, several, stalked, in a raceme 1-7 cm tall. Flowers about 3 mm wide, 2. lower petal (lip) deeply divided into 2 narrow lobes with a horn-like tooth on each side of the lip base. Sepals and upper petals lanceolate-ovate, spreading. Column short.



fruit: Dry capsules.

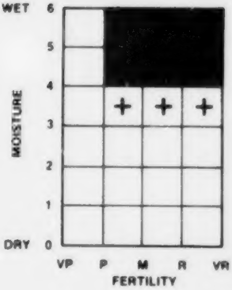




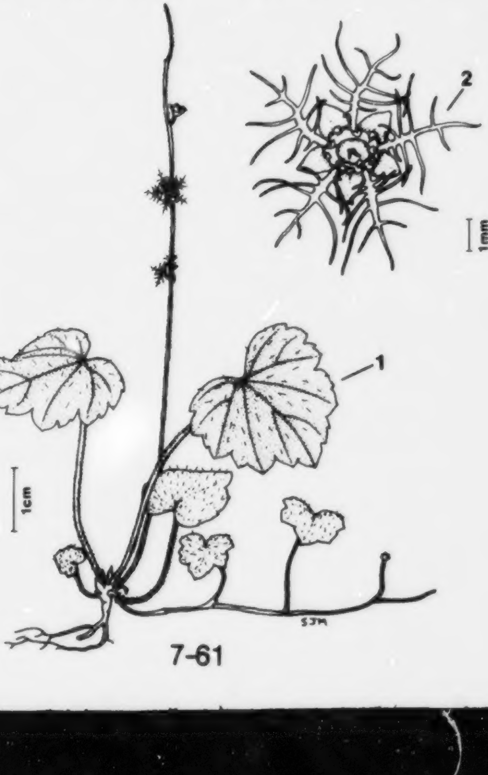
a. plant
b. flower

Mitella nuda
Naked Mitrewort

59



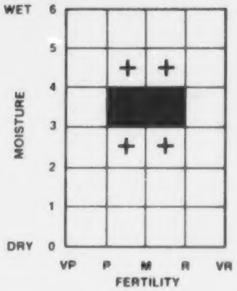
form: Low, creeping, perennial herb. Flowering stems 0.5-2 dm tall.
leaves: Basal, simple, petioled. **1.** Blade broadly ovate-cordate, 2-5 cm wide, shallowly 5-7 lobed and blunt-toothed, coarsely hairy above and on petioles.
flowers: Yellowish-green, 2-13, 7-11 mm wide, stalked,in a thin raceme. Sepal lobes 5, short-pointed; **2.** petals 5, 3-5 mm long, pinnately divided into 8-10 slender segments; stamens 10, small.
fruit: Short, beaked capsules, splitting into 2 parts. Seeds black, small and shiny.



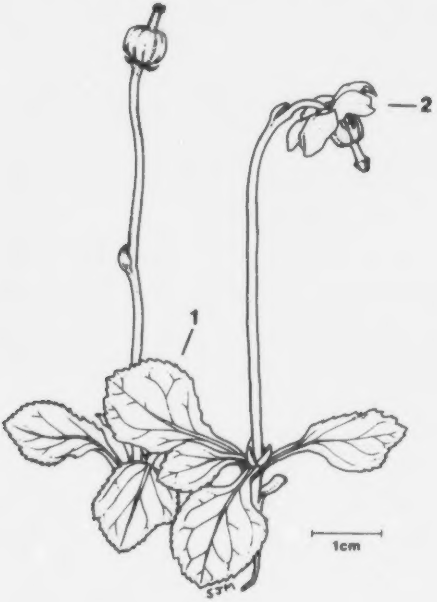
a. plant
b. flower

Moneses uniflora
One-flowered Wintergreen

60



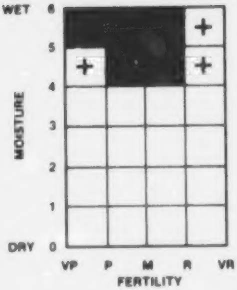
form: Low perennial herb, spreading by slender rhizomes, forming small colonies.
leaves: Basal, usually 3-4, simple, evergreen. 1. Blade rounded to ovate, narrowing to a petiole, tip blunt-pointed, margins toothed. Young plants with leaves in a rosette around prominent flower bud.
flowers: White, to pinkish, 1-2 cm wide, solitary on a smooth stalk, 3-10 cm tall. Flower fragant, 2. nodding, petals 5, waxy, spreading. Stamens 10; ovary large, rounded, with a protruding style and 5-lobed stigma.
fruit: An erect capsule.

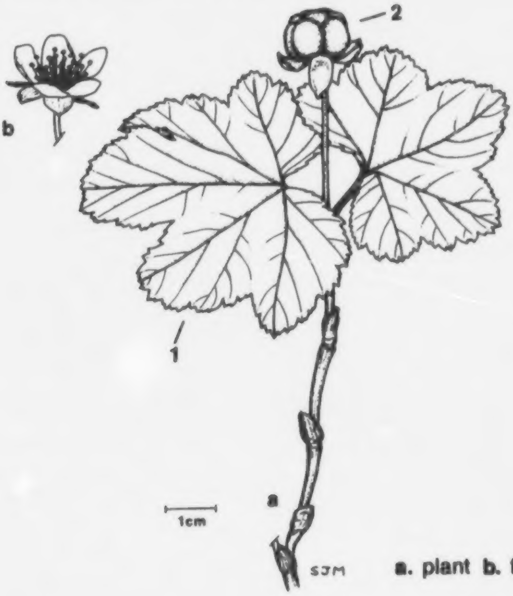


Rubus chamaemorus
Bake-apple

61

form: Perennial herb, with smooth, upright branches, 1-2.5 dm tall, from creeping rhizomes.
leaves: Alternate, usually 2, simple, petioled. 1. Blade rounded to broadly ovate-cordate, 4-9 cm wide, dark green, rough-textured, somewhat 5-lobed, margins toothed.
flowers: White, solitary, to 2.5 cm wide, male and female flowers on separate plants. Sepal lobes 5, pointed; petals 5, obovate, spreading; stamens numerous, pistils many.
fruit: 2. Red becoming amber, translucent and soft when ripe. A berry-like cluster of several large drupelets crowded on a dry base. Edible.



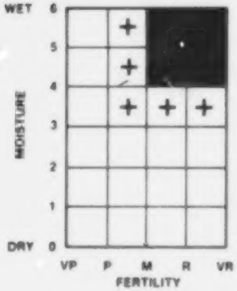


a. plant **b.** flower

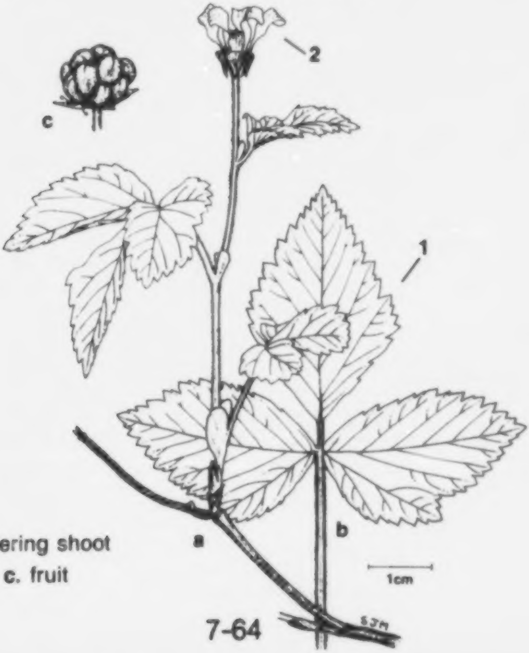
Rubus pubescens
Dewberry

62

form: Trailing perennial with erect flowering shoots, 1-4 dm tall, from woody stolons. Leafy shoots ending in rooting tips. Stems and petioles hairy.
leaves: Alternate, compound, 4-10 cm long, petioled. Leaflets 3-5, **1.** central leaflet widest at the middle, base wedge-shaped, stalked; lateral leaflets ovate, sessile, margins coarsely double-toothed, leaves smooth or velvety beneath.
flowers: White to pale pink, 1-3, terminal. Sepal lobes 5, reflexed; **2.** petals 5, erect, 6-10 mm long; stamens and pistils numerous.



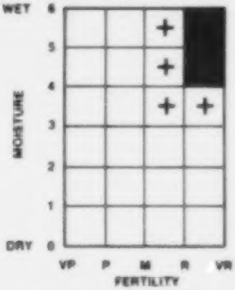
fruit: Dark red berry-like cluster of several drupelets, 1-1.5 cm wide.

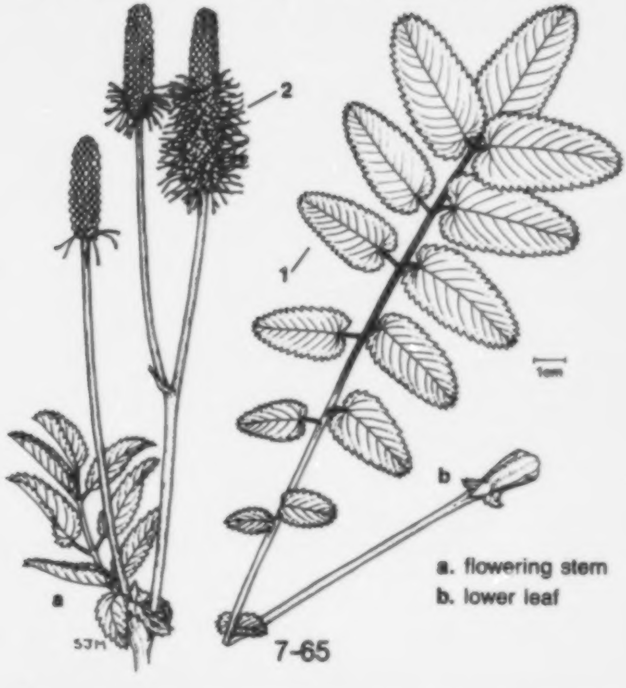


a. flowering shoot
b. leaf **c.** fruit

Sanguisorba canadensis 63
Bottlebrush

form: Perennial herb, 0.3-2 m tall. Stems smooth.
leaves: Alternate, pinnate-compound, long-petioled, lower leaves to 5 dm long. Blades divided into 1. 7-17 stalked leaflets, the largest 2.5-10 cm long, lanceolate-ovate to oblong, base rounded to cordate, tip blunt, margins coarsely toothed. Upper leaves reduced, shorter petioled.
flowers: White, numerous, crowded in a dense, cylindrical spike at the end of a long stem. Sepal lobes 4, broad, petal-like; petals none; stamens 4, 2. filaments long, white, extending outward.
fruit: An achene.



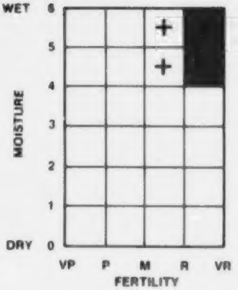


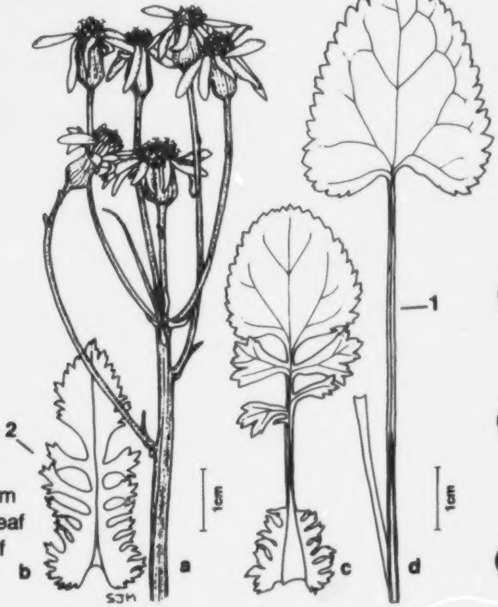
a. flowering stem
b. lower leaf

Senecio aureus
Golden Ragwort

64

form: Perennial herb, 0.2-1.2 m tall, from a creeping rhizome.
leaves: Basal and alternate, smooth when mature. Basal leaves simple, **1.** long-petioled; blades ovate, to 11 cm long, base somewhat cordate, tip rounded, margins blunt-toothed. Stem leaves reduced upwards, **2.** pinnately divided, becoming sessile, margins coarsely toothed.
flowers: Yellow heads, 5-13 mm long, few to many, terminal. Rays 6-13 mm long.
fruit: A smooth achene tipped with bristles.



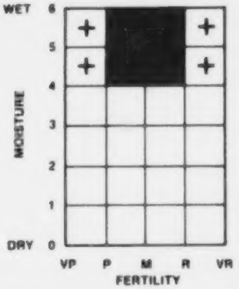


a. flowering stem
b. upper stem leaf
c. mid-stem leaf
d. basal leaf.

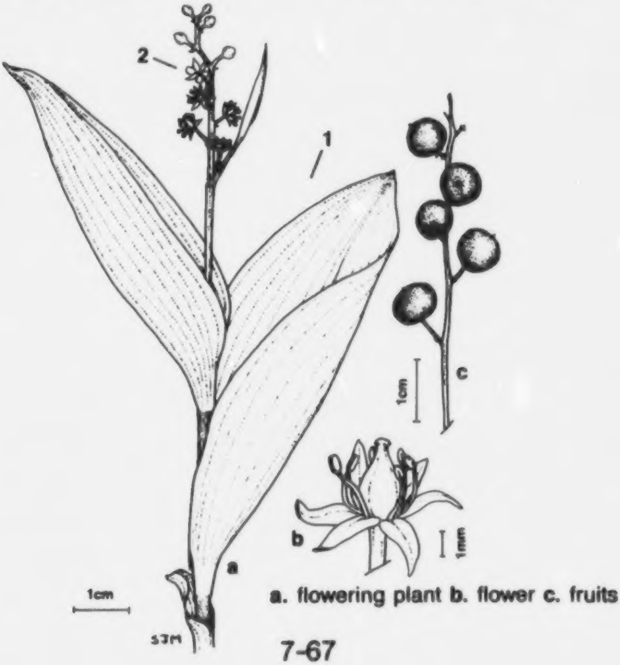
Smilacina trifolia
Three-leaved Solomon's Seal

65

form: Perennial herb, from creeping rhizome. Stems smooth, to 2 dm tall.
leaves: Basal, simple, commonly 2 in sterile plants, with a prominent, large terminal bud; **1.** in flowering plants, 2-3, alternate. Blades lanceolate to broad-elliptic, 5-12 cm long, smooth, narrowing to a sessile clasping base, tip pointed, margins entire.
flowers: **2.** White, star-like, stalked, several in a slender raceme 2-8 cm long, taller than the leaves. Sepals and petals alike, 6; stamens 6.



fruit: Red, translucent, round berry. Green, speckled with red when young. Inedible.



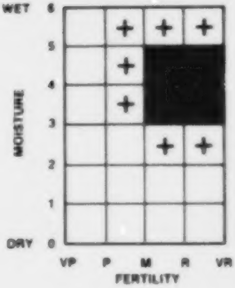
a. flowering plant b. flower c. fruits

Solidago macrophylla
Large-leaved Goldenrod

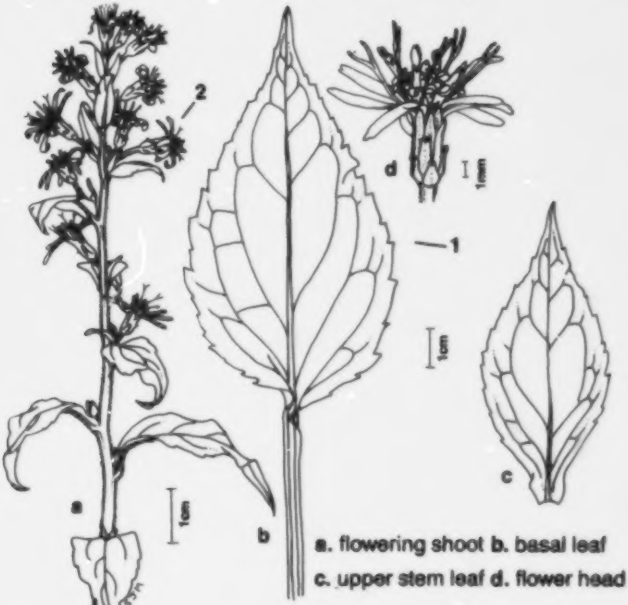
form: Tall perennial herb, 0.1-1 m tall. Stem hairy above.

leaves: Basal and alternate, simple, smooth, except on veins. 1. Basal leaves large, long-petioled; blade ovate to elliptic, 2-15 cm long, narrowing to the petiole, tip long pointed, margins coarsely toothed. Stem leaves elliptic to lanceolate, reduced above, with progressively shorter petioles. Upper leaves sessile, with entire margins.

flowers: Yellow heads, 8-11 mm high, 2. in terminal and axillary clusters. Rays long, linear, 7-12.



fruit: A smooth achene with bristles at top.



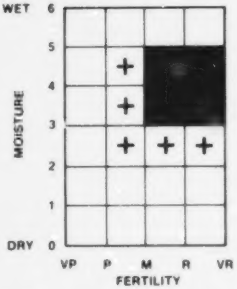
a. flowering shoot b. basal leaf
c. upper stem leaf d. flower head

Solidago rugosa 67
Rough-stemmed Goldenrod

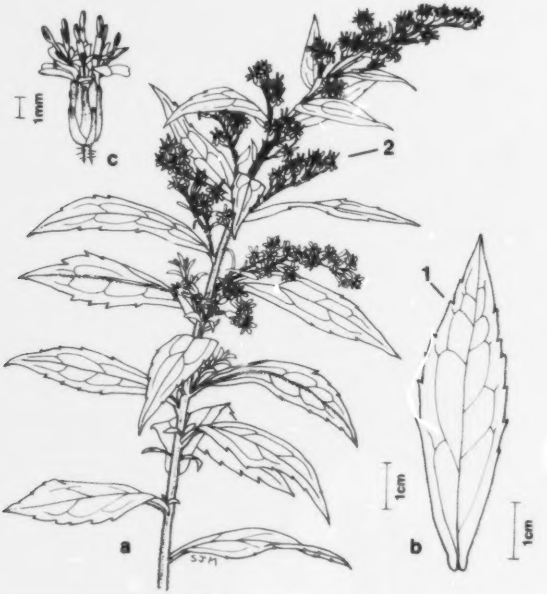
form: Tall, perennial herb, 0.4-2 m tall. Stem hairy and rough, very leafy.

leaves: Alternate, simple, sessile, 3.5-13 cm long. **1.** Blade elliptic to lanceolate, rough-textured, tapering to base, tip long-pointed, margins toothed to entire on upper reduced leaves.

flowers: Yellow heads, numerous, **2.** in many curved, one-sided clusters, each above a leafy bract. Heads small, 2.5-5.5 mm high, rays short, 6-11, disk flowers 4-7.



fruit: Achene finely hairy and with bristles at top.

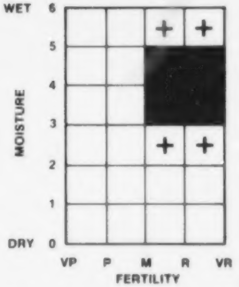


a. flowering stem b. leaf c. flower head

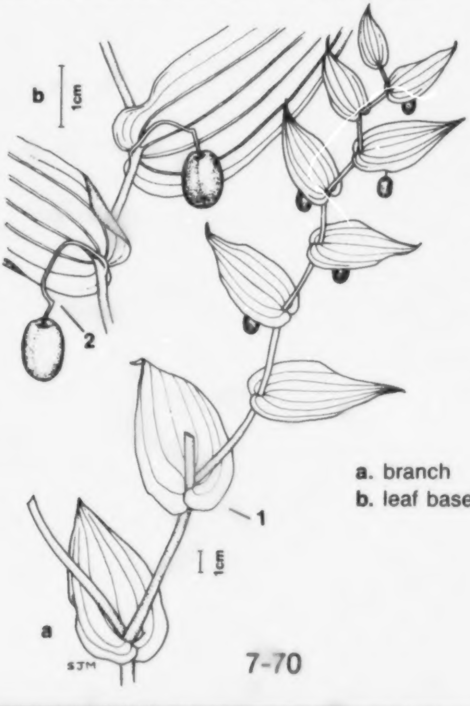
Streptopus amplexifolius
Twisted-stalk

68

form: Perennial herb, 4-10 dm tall. Stem smooth.
leaves: Alternate, simple, 6-12 cm long. Blades smooth, lanceolate-ovate, **1.** bases cordate, clasping, tips long-pointed, whitish below with margins entire and smooth, or green below and margins with fine hairs.
flowers: Greenish-white, bell-shaped, hidden beneath leaves, 1 or 2 in each leaf axil. Flower stalks twisted, 3-5 cm long, **2.** jointed at ⅔ their length. Sepals and petals alike, 6, spreading from the middle.



fruit: Orange-red to scarlet, ovoid to round berry, 1-1.5 cm long. Inedible.



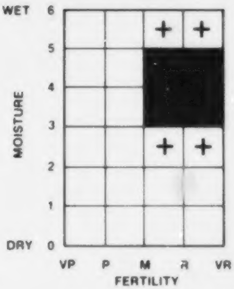
a. branch
b. leaf bases and fruit

Streptopus roseus Twisted-stalk

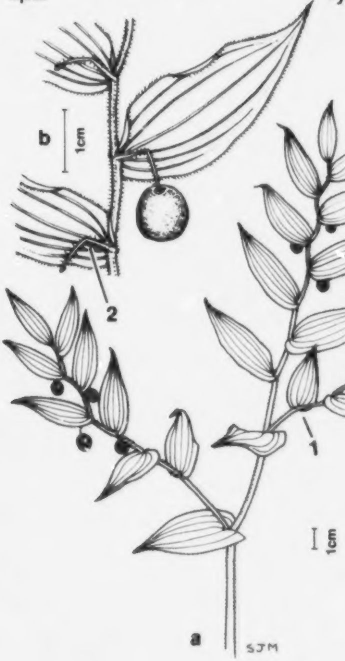
form: Perennial herb, 3-8 dm tall. Stem finely hairy.

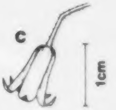
leaves: Alternate, simple, 5-9 cm long. Blade lanceolate to ovate, base rounded, **1.** sessile, not clasping, tip long-pointed, margins entire, with fine hairs.

flowers: Rose-pink, bell-shaped, hidden beneath leaves, 1 in each leaf axil, Flower stalks twisted, 1-3 cm long, **2.** jointed at or below the middle. Sepals and petals alike, 6, spreading only at the tips.



fruit: Cherry-red, rounded berry, 1 cm wide. Inedible.



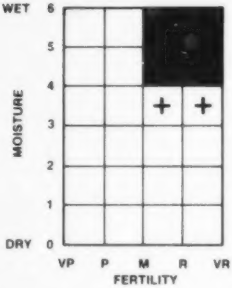


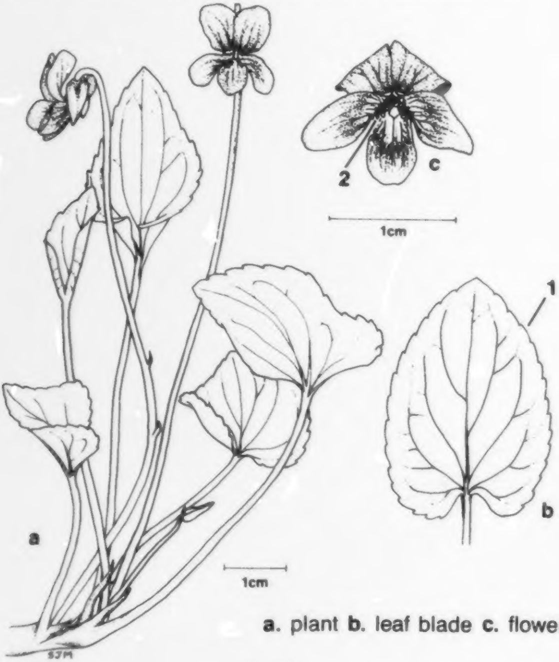
a. plant
b. leaf bases and fruit
c. flower

Viola cucullata
Blue Marsh Violet

70

form: Low, perennial herb, from a thick rhizome.
leaves: Basal, simple, long petioles, smooth. Blade **1.** ovate-cordate, smooth, to 10 cm long, tip blunt-pointed, margins blunt-toothed.
flowers: Blue-violet, darker toward the center; stalk smooth, taller than the leaves. Petals 5, lateral 2 with **2.** white beard of round-tipped hairs; lower petal smooth, spurred, shorter than the lateral petals.
fruit: Green, ovoid capsule, 1-1.5 cm long, splitting into 3 parts, seeds blackish.





a. plant **b.** leaf blade **c.** flower

Viola incognita

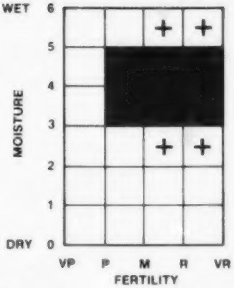
Large-leaved White Violet

form: Low perennial herb, with **1.** thin runners forming large colonies.

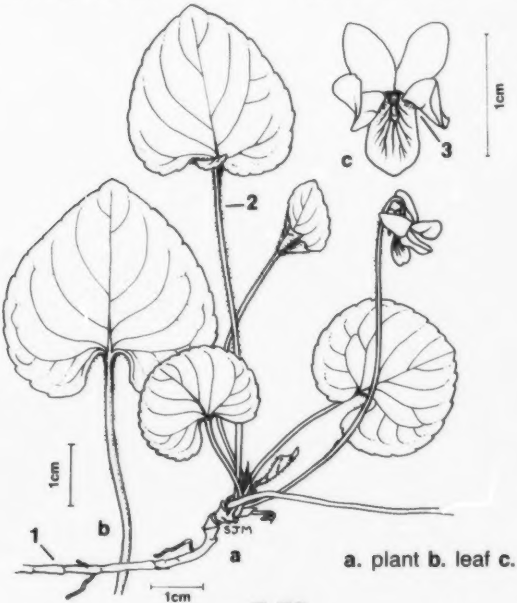
leaves: Basal, simple, **2.** long petioles and leaves downy when young, becoming smooth. Blade broadly ovate-cordate, 2.5-8 cm wide, early leaves with rounded tips, later leaves blunt-pointed, margins blunt-toothed.

flowers: White, 1 cm wide, flower stalk long and downy. Petals 5, **3.** lateral 2 bearded, lower petal smooth, purple-veined.

fruit: Purplish, ovoid capsule, 4-6 mm long, splitting into 3 parts, seeds greenish-brown.



Note: A similar white-flowered species, *Viola renifolia*, is without runners, the largest leaves are wider than long, all tips are rounded.



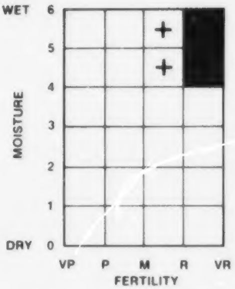
a. plant **b.** leaf **c.** flower

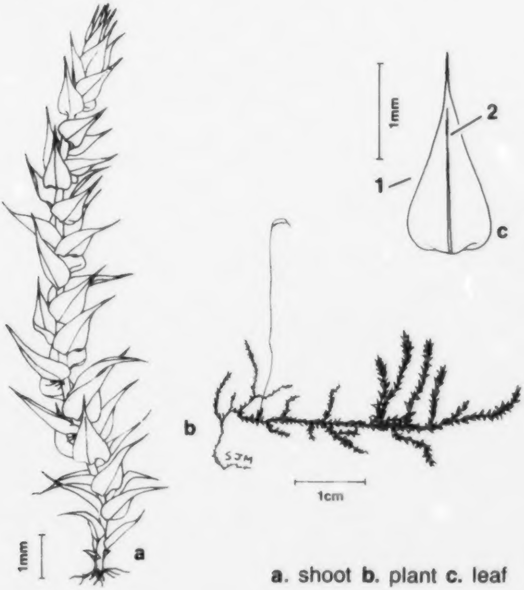
Campylium polygamum

72

form: Slender moss in low, green to yellowish green mats. **plant:** Stems smooth, branched, horizontal to ascending, with erect shoots. **leaves:** 2.0-2.5 mm long, erect spreading, shiny, **1.** ovate-lanceolate, tip long pointed, margins entire. **2.** Costa single, extending to ½ or more leaf length.

Note: A similar species, *Campylium stellatum* (Hedw.) C. Jens., found in fens, has wider leaves and costa none or very short, single or forked.





a. shoot **b.** plant **c.** leaf

Dicranum majus

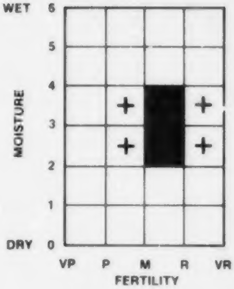
73

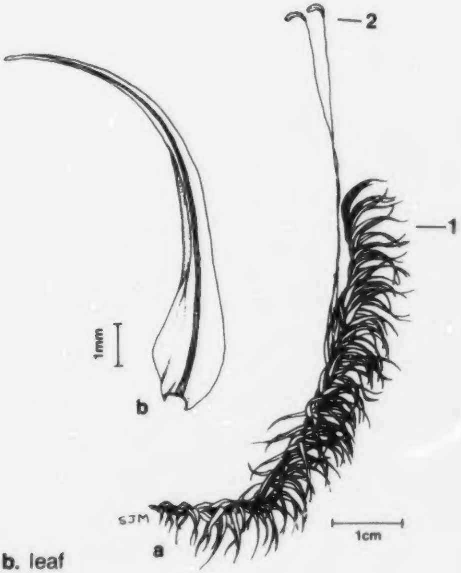
form: Robust moss in green to yellowish loose tufts 5-13 cm high.

plant: Stems simple or forked, erect, covered with short white to brownish hairs. **1.** At top of stem, leaves all curved to one side.

leaves: 9-15 mm long, glossy, narrow lanceolate, tip long, slender, curved, finely toothed. Costa single, extending to, or just below, the tip.

sporophytes: 2. In clusters of 2-4, occasionally 1, 2.5-3.5 cm tall.





a. plant **b.** leaf

Dicranum polysetum

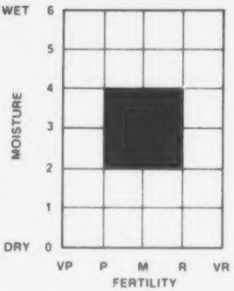
74

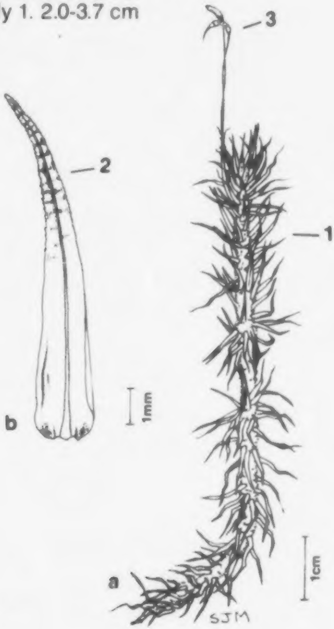
form: Robust moss in light green to yellowish loose tufts 2-15 cm tall.

plant: Stems simple or forked, erect, densely covered with short white to light brown hairs. **1**. Leaves spreading in several directions, not bent to one side.

leaves: 8-10 mm long, **2**. undulate, glossy, lanceolate, tip long pointed, margin toothed above the middle. Costa single, extending nearly to tip.

sporophytes: 3. In clusters of 2-5, occasionally 1. 2.0-3.7 cm tall.





a. plant **b**. leaf

Dicranum scoparium
Broom Moss

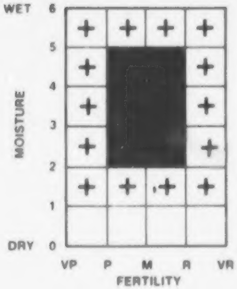
75

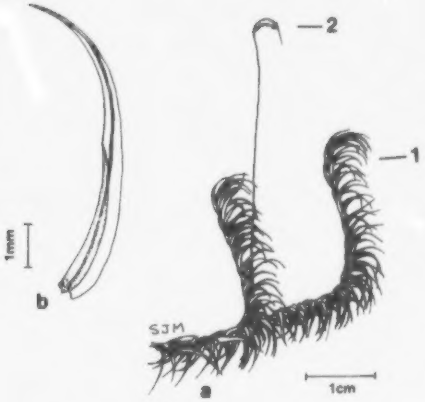
form: Fairly robust moss in green to yellowish green cushions 2-8 cm high.

plant: Stems simple to forked, erect, covered with short brown hairs; **1.** leaves usually curved to one side, occasionally erect spreading.

leaves: 3.5-9.0 mm long, narrow lanceolate, keeled above, tip long, slender, curved, margins finely toothed in upper ⅓. Costa single, extending to the tip, with 4 ridges on back of costa.

sporophyte: **2.** Single, 1.8-3.5 cm tall.



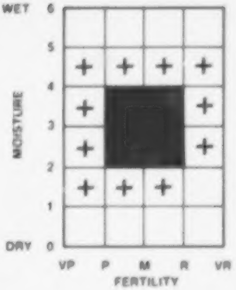


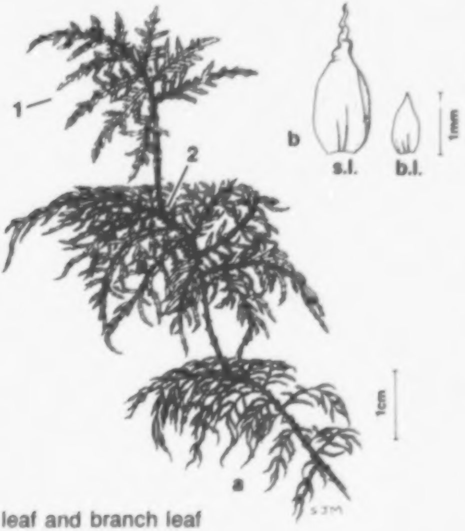
a. plant **b.** leaf

Hylocomium splendens
Stair-Step Moss

76

form: Large, delicate feather-moss, forming dull, green to brownish mats.
plant: Stems arched, spreading, **1.** bi- to tri-pinnate, forming broad, flat, triangular fronds in step-like layers, **2.** each year's growth rising from mid-stem of the previous year's. Stems red, covered with short branched hairs; branches tapering.
leaves: *Stem leaves* 2-3 mm long, ovate, concave, tip long-pointed, wrinkled in mature leaves. Costa double, ⅓-½ leaf length. *Branch leaves* to 1.5 mm long, ovate, pointed, costa double, short.





a. plant b. stem leaf and branch leaf

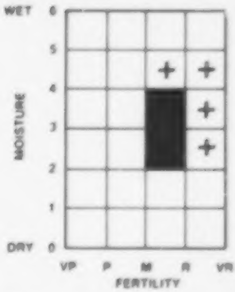
Hylocomium umbratum

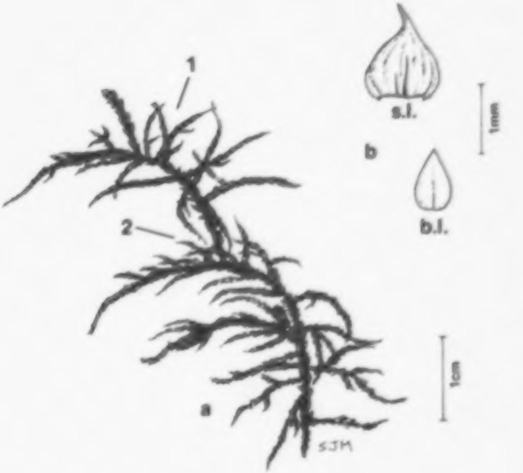
77

form: Slender moss forming loose, dark green to brownish mats.

plant: **1.** Stems arching, branching irregular, fronds bushy, **2.** each year's growth rising from mid-stem of the previous year's. Stem covered with short, branched hairs; branches tapering.

leaves: *Stem leaves* 1.5-2.0 mm long, broadly ovate, with vertical folds, tip long-pointed, margins finely toothed. Costa double, ½-⅔ leaf length. *Branch leaves* to 1 mm, ovate, pointed, costa to above the middle.



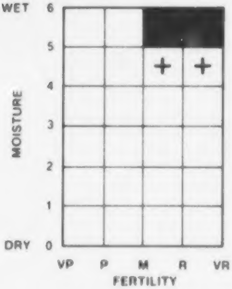


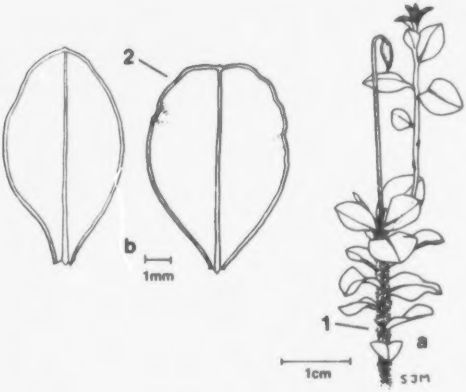
a. plant b. stem leaf and branch leaf

Mnium punctatum

78

form: Large-leaved moss forming loose, dark green clumps.
plant: Stems erect, unbranched, 4-10 cm tall, **1.** densely covered with brown wooly hairs.
leaves: Large, to 12 mm long, thin, spreading; widely spaced, but often crowded near the tip, forming a loose terminal rosette. **2.** Leaves broad-elliptic to obovate, tapering to a narrow base, tip rounded to slightly notched, margins smooth, bordered. Costa single, extending to, or just below, the tip.

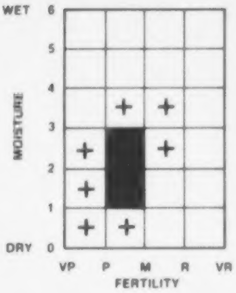


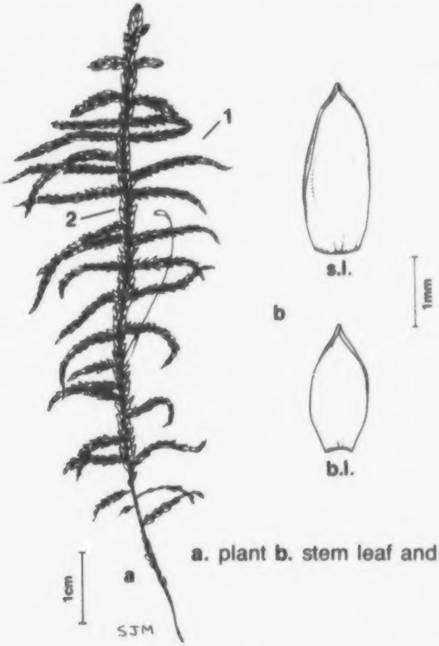


a. fertile plant with young offshoot. **b.** leaves

Pleurozium schreberi 79

form: Robust feathermoss, forming extensive, loose light green to golden mats.
plant: **1.** Branching irregular-pinnate, stems ascending, 7-16 cm long, **2.** red, smooth, visible through the leaves. Branches fairly stout, tapering.
leaves: Shiny, overlapping, giving stem and branches a smooth, cylindrical appearance. *Stem leaves* 1.8-2.4 mm long, oblong-ovate, deeply concave, tip blunt to pointed, margins incurved. Costa short, double. *Branch leaves* smaller, ovate, concave.



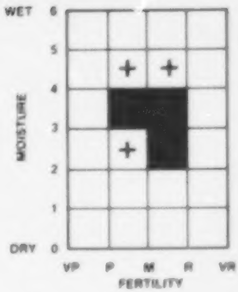


a. plant **b.** stem leaf and branch leaf

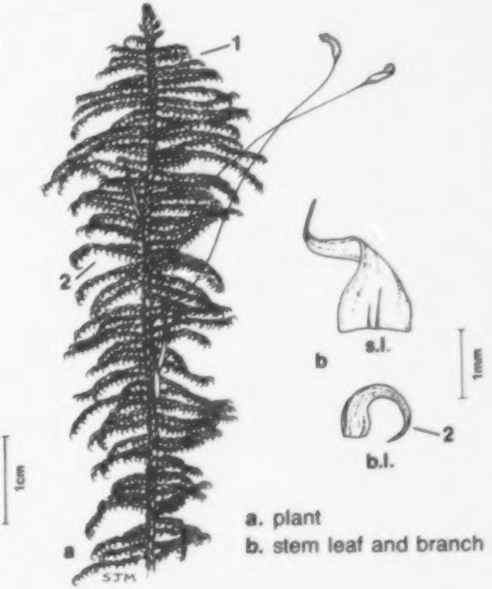
Ptilium crista-castrensis

Plume Moss

80

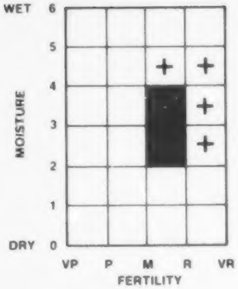


form: Robust, shiny feather-moss, forming bright green to golden mats.
plant: **1.** Branching regular, tightly pinnate, forming ascending, flat, oblong, triangular-tipped, feather-like fronds, to 11 cm long. Stem and branch tips curved.
leaves: *Stem leaves* 2-3 mm long, ovate-triangular, with vertical folds, tip long-pointed, curled. Costa short, double. *Branch leaves* to 2 mm long, **2.** lanceolate, with long-pointed tips strongly curved downward.

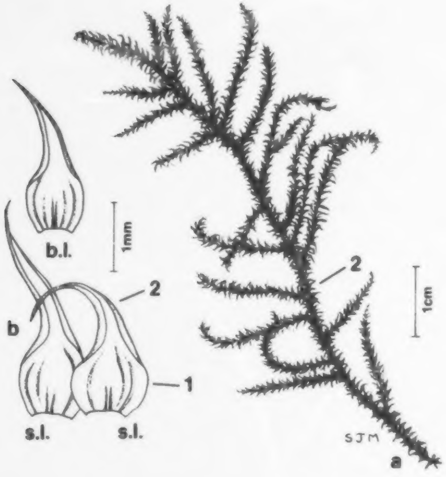


a. plant
b. stem leaf and branch leaf

Rhytidiadelphus loreus 81



form: Robust moss in loose, bright to yellowish green, spreading mats.
plant: Stems creeping, to 15 cm long, branching irregular to somewhat pinnate; stems and branches reddish, smooth. Stem tips curved, branch tips tapering.
leaves: *Stem leaves* 2.5-4.0 mm long, crowded on stem; **1.** ovate, with vertical folds, **2.** squarrose (bent backward sharply at middle of leaf) or curved, tip narrow, very long pointed. Costa double, less than ¼ leaf length. *Branch leaves* erect to spreading, similar to stem leaves but smaller, curved, not squarrose.



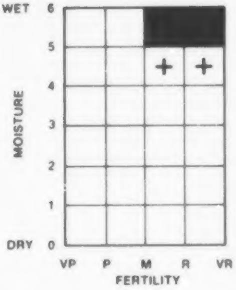
a. plant **b.** stem leaves and branch leaf

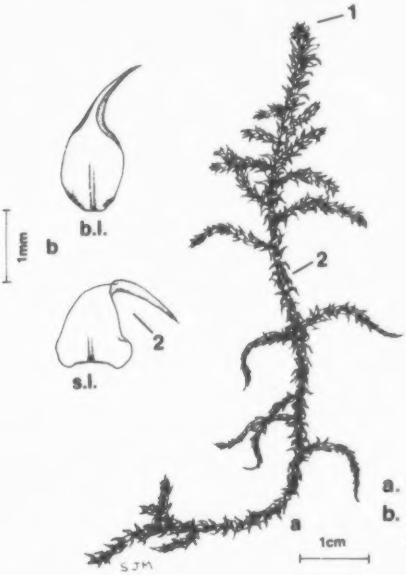
Rhytidiadelphus squarrosus 82

form: Fairly robust moss in loose bright green to yellowish tufts.

plant: Stems loosely ascending to 15 cm long, branching irregular to somewhat pinnate. Stems reddish, smooth; **1.** stem tips appear star-like due to recurved leaves.

leaves: *Stem leaves* 2.5-3.2 mm long, not crowded, stem visible between leaves. Leaves broadly ovate, without folds, **2.** squarrose (bent backward sharply at middle), tip narrow, long pointed. Costa double, about ½ leaf length. *Branch leaves* smaller, ovate, not bent back, crowded, spreading.



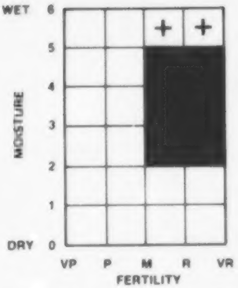


a. plant

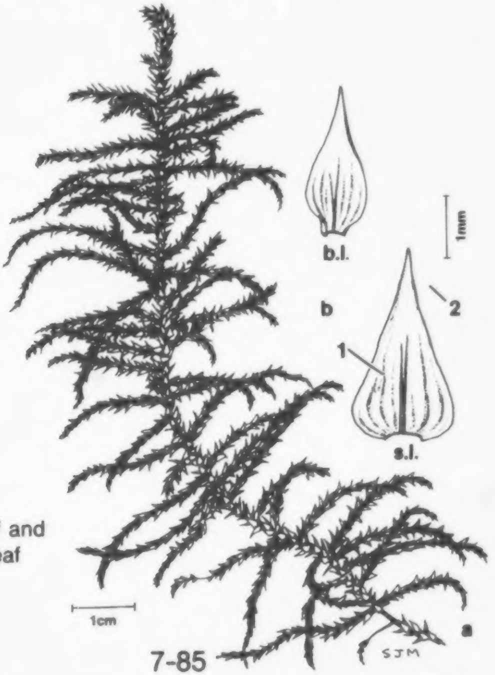
b. stem leaf and branch leaf

Rhytidiadelphus triquetrus
Shaggy Moss

83



form: Coarse, robust moss in bright to yellow green, loosely spreading mats.
plant: Stems creeping to erect, to 20 cm long, branching in various directions; stems and branches reddish, smooth. Stem tips with a dense cluster of spreading leaves, branch tips tapering.
leaves: *Stem leaves* 3.5-5.0 mm long, not crowded, stem visible between leaves. **1.** Leaves triangular, with vertical folds, erect to spreading, **2.** tip pointed, not bent back. Costa double, about ⅔ leaf length. *Branch leaves* smaller, ovate, with vertical folds, more crowded, spreading.

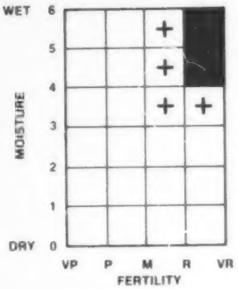


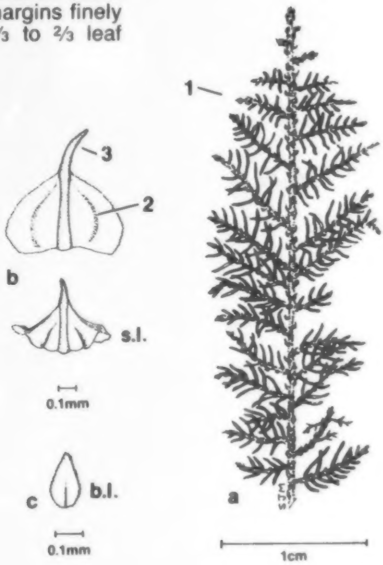
a. plant
b. stem leaf and branch leaf

Thuidium recognitum

84

form: Robust moss in light green to yellowish brown mats. **plant:** Stems spreading or arched, to 9 cm long, **1.** bipinnate, feather-like. Stems and branches densely covered with short branched hairs. **leaves:** *Stem leaves* to 1 mm long, widely spaced, **2.** broadly ovate, with vertical folds, concave, margins finely toothed, **3.** costa broad, extending beyond leaf blade. *1° branch leaves* similar, but with shorter costa. *2° branch leaves* ovate, pointed, margins finely toothed, costa ⅓ to ⅔ leaf length.

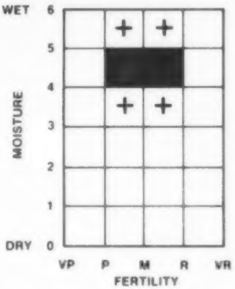




a. plant **b.** stem leaf: flattened (top) and as on stem (bottom)
c. 2° branch leaf

Sphagnum girgensohnii

85 86

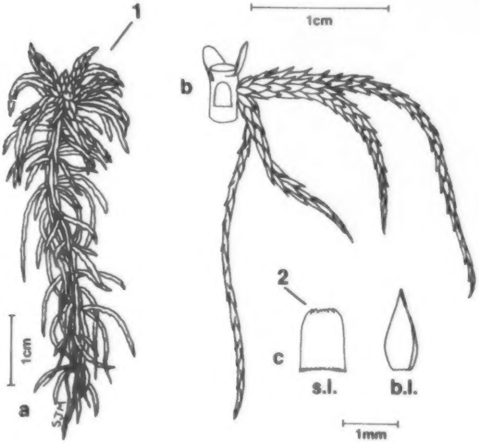


form: Fairly robust moss in loose carpets.

plant: Green, never reddish. **1.** Head flat, branches arranged in 5 distinct arms, with a star-like appearance. Branches in groups of 4-5 with 2-3 spreading; lower branches long, drooping.

leaves: *Stem leaves* broad-oblong, **2.** tip blunt to flattened, fringed. *Branch leaves* ovate, pointed, upper margins incurved.

Note: A similar species with star-like heads, *Sphagnum russowii* Warnst., is green speckled with red, its stem leaves reddish, less fringed, and branches in groups of 3-4 with 2 spreading.

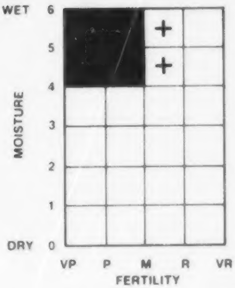


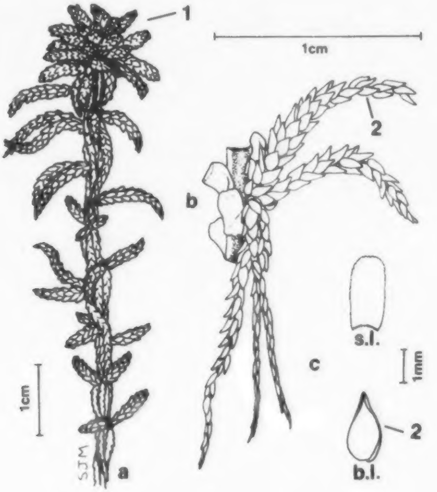
a. plant **b.** branch group **c.** stem leaf and branch leaf

Sphagnum magellanicum

87 88

form: Robust moss in fairly dense cushions.
plant: Red to purplish, shiny, occasionally green in shade. Stem red, **1.** branches short, plump, in groups of 4-5, usually with 2 spreading.
leaves: *Stem leaves* oblong, flat, tip rounded, finely fringed. *Branch leaves* ovate, **2.** deeply concave, margins incurved at pointed tip.
Note: A similar species with stout branches, *Sphagnum papillosum* Lind., is dull, yellowish brown to pale green.

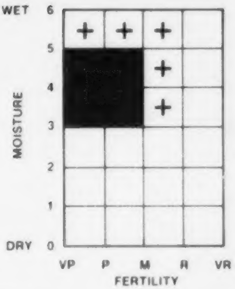


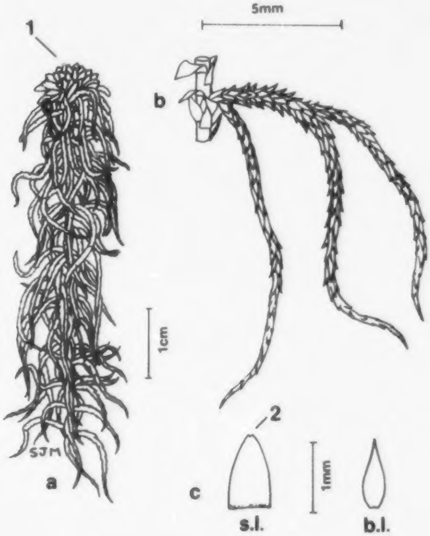


a. plant **b.** branch group **c.** stem leaf and branch leaf

Sphagnum nemoreum

form: Slender moss in dense cushions.
plant: Light or yellow-green, tinged with pink or red. **1.** Head rounded, compact with short blunt branches. Branches in groups of 3-4 with 2 spreading.
leaves: *Stem leaves* **2.** oblong-ovate, blunt pointed, tip notched or slightly fringed at center. *Branch leaves* lanceolate-ovate, pointed, margins incurved at tip; not arranged in distinct rows.
synonym: *Sphagnum capillifolium* var. *tenerum* (Sull. & Lesq. ex Sull.) Crum; *Sphagnum capillaceum* Schrank.





a. plant **b.** branch group **c.** stem leaf and branch leaf

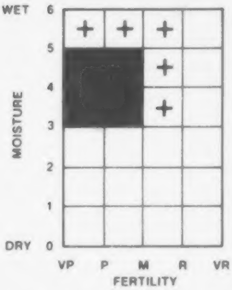
Sphagnum quinquefarium

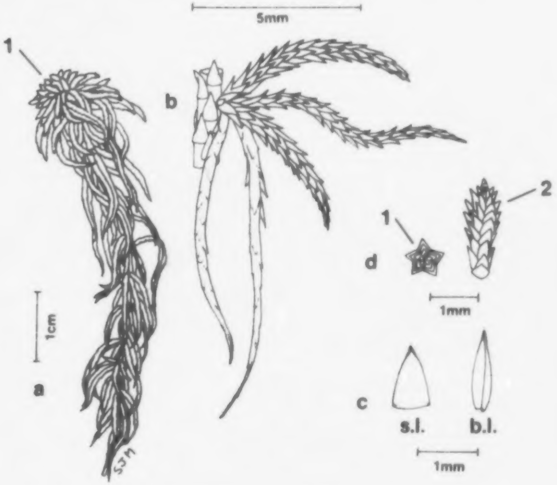
90

form: Slender moss in carpets or cushions.

plant: Light green, yellowish or pink-tinged. Branches fairly short, in groups of 4-5, usually with 3 spreading. **1.** Looking down on head when dry, each short branch tip appears star-shaped due to the **2.** distinct 5-ranked, spirally arranged branch leaves.

leaves: *Stem leaves* oblong-triangular, short-pointed with edges of tip incurved. *Branch leaves* lanceolate-ovate, concave, pointed, **2.** arranged in 5 distinct spiral rows, spreading at tips when dry.

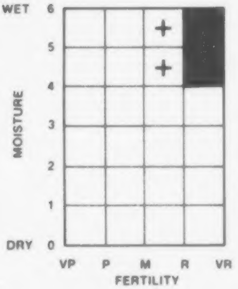


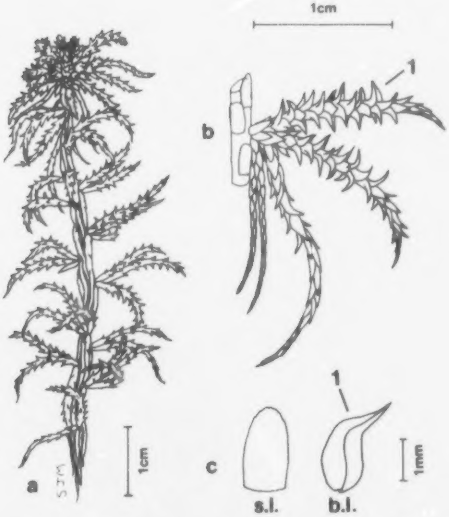


a. plant **b.** branch group **c.** stem leaf and branch leaf **d.** branch tip: top view (l) and side view (r)

Sphagnum squarrosum 91

form: Robust moss in loose carpets.
plant: Pale green to yellowish. Branches in groups of 5 with 2 spreading, one of the 3 pendant branches larger, somewhat similar to the spreading branches.
leaves: *Stem leaves* oblong, the broad rounded tip slightly fringed. *Branch leaves* ovate, concave, narrowed to a pointed tip, 1. squarrose (bent backward sharply at middle of leaf), margins incurved, tips wide spreading when wet or dry.





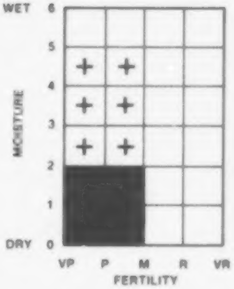
a. plant **b.** branch group **c.** stem leaf and branch leaf

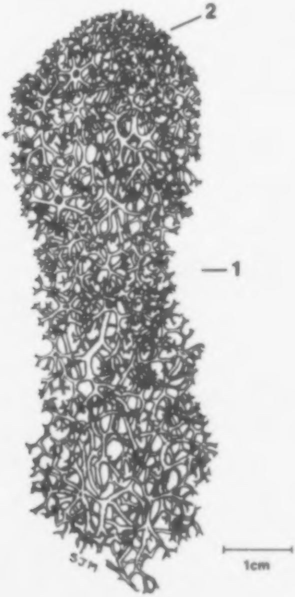
Cladonia alpestris

92

form: White to pale yellowish-gray lichen, 6-10 cm tall, forming rounded clumps, often in loose colonies. Branches less than 1 mm wide, hollow, brittle when dry, axils of branches open, repeatedly and finely branched, **1.** clumps with no main stems.

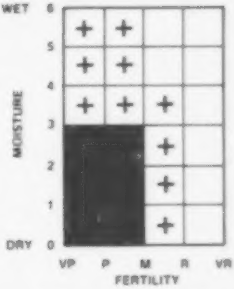
branches: Very finely branched, tips thin and slender, pointed in all directions, forming **2.** dense, rounded tops on the elongate clumps.



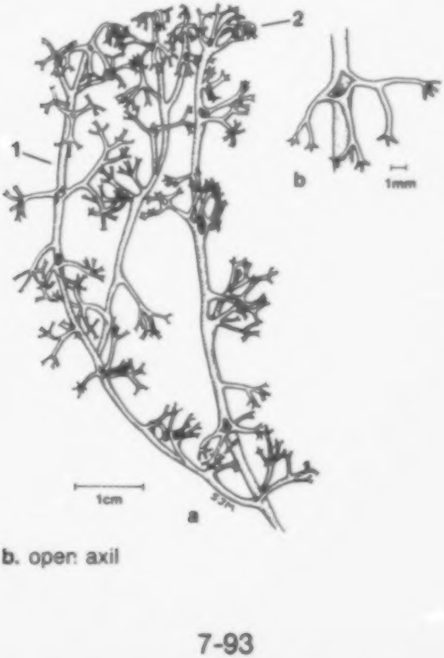


Cladonia arbuscula
Reindeer Moss

93 94 95



form: Pale yellowish-gray lichen, 6-10 cm tall, often forming extensive colonies. Stems and branches hollow, brittle when dry; axils of branches open. **1.** Main stem present.
branches: In 3's or 4's, rather coarse, **2.** upper branch tips strongly pointed in one direction. Chemical trait: P + red on branch tips.
Note: *Cladonia mitis* Sandst., also yellowish, has finer branch tips pointed in various directions. Chemical trait: P-. *Cladonia rangiferina* (L.) Wigg. the true Reindeer Moss, also has branch tips pointed in one direction, but is ash-gray to pale brownish-purple.



a. plant **b.** open axil

PLANT PHOTOGRAPHS

photo S.J Meades

Epigaea repens (23)

SHRUBS

Acer rubrum 1
(Red Maple)

Acer spicatum 2
(Mountain Maple)

Alnus crispa 3
(Mountain Alder)

Alnus rugosa 4
(Speckled Alder)

Cornus stolonifera **5**
(Red-Osier Dogwood)

Kalmia angustifolia **6**
(Sheep Laurel)

Ledum groenlandicum **7**
(Labrador Tea)

Nemopanthus mucronata **8**
(Mountain Holly)

Rhamnus alnifolia (Alder-leaved Buckthorn) 9

Rhododendron canadense (Rhodora) 10

Ribes glandulosum (Skunk Currant) 11

Ribes hirtellum (Smooth Gooseberry) 12

Ribes lacustre 13
(Bristly Black Currant)

Ribes triste 14
(Swamp Red Currant)

Rubus idaeus 15
(Wild Raspberry)

Sambucus pubens 16
(Red Elderberry)

SHRUBS

17

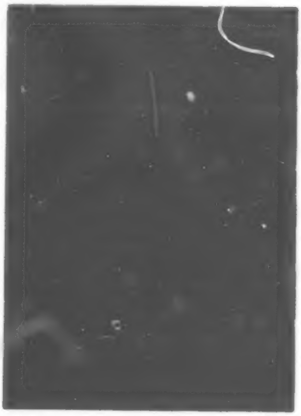
Taxus canadensis
(Canadian Yew)

18

Vaccinium angustifolium
(Low Bush Blueberry)

19

Vaccinium ovalifolium
(Oval-leaved Bilberry)



20

Viburnum cassinoides
(Wild Raisin)

Viburnum edule **21**
(Squashberry)

Viburnum trilobum **22**
(Highbush-Cranberry)

Epigaea repens **23**
(Mayflower or Trailing Arbutus)

Gaultheria hispidula **24**
(Creeping Snowberry)

FERNS

Athyrium filix-femina **25**
(Lady Fern)

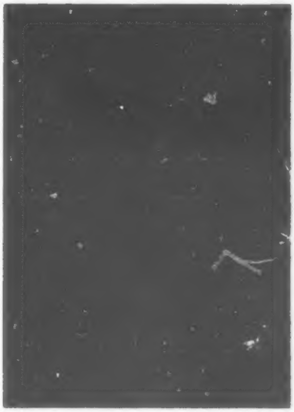
Dryopteris disjuncta **26**
(Oak Fern)

Dryopteris noveboracensis **27**
(New York Fern)

Dryopteris phegopteris **28**
(Long Beech-Fern)

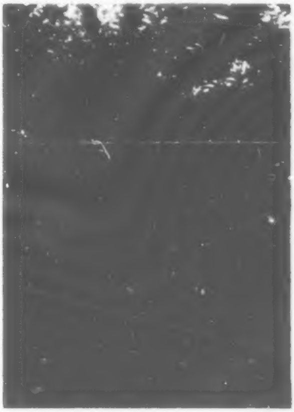
FERNS

Dryopteris spinolusa var. ***typicum*** **29**
(Spinulose Wood Fern)



Dryopteris spinulosa v. ***americana*** **30**
(Mountain Wood Fern)

Dryopteris spinulosa v. ***intermedia*** **31**
(Evergreen Wood Fern)



Osmunda cinnamomea **32**
(Cinnamon Fern)

FERNS/FERN ALLIES

Pteridium aquilinum 33
(Bracken Fern)

Equisetum sylvaticum 34
(Woodland Horsetail)

Lycopodium annotinum 35
(Bristly or Stiff Clubmoss)

Lycopodium lucidulum 36
(Shining Clubmoss)

GRASSES

37
Calamagrostis canadensis
(Blue-Joint)

38
Cinna latifolia
(Wood Reedgrass)

39
Deschampsia flexuosa
(Hair Grass)

40
Glyceria canadensis
(Rattlesnake Grass)

SEDGES/FORBS

Carex flava 41

Carex leptonervia 42

Carex trisperma 43

Actaea rubra 44
(Red Baneberry)

45

Aralia nudicaulis
(Wild Sarsaparilla)

46

Aster puniceus
(Purple-Stemmed Aster)

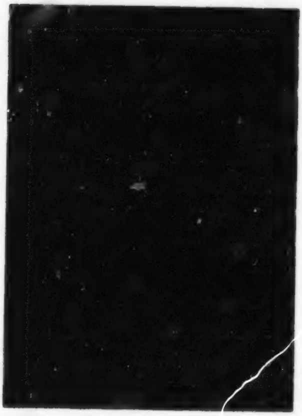
47

Caltha palustris
(Marsh-Marigold)

48

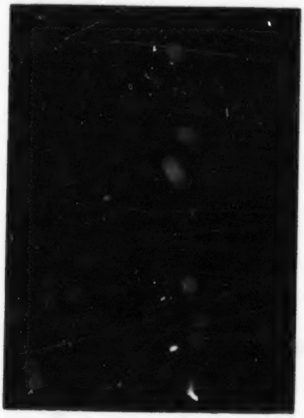
Circaea alpina
(Dwarf Enchanter's Nightshade)

Clintonia borealis **49**
(Yellow Clintonia)



Coptis groenlandica **50**
(Goldthread)

Cypripedium reginae **51**
(Showy Lady-Slipper)



Galium kamtschaticum **52**

Galium triflorum **53**
(Sweet-Scented Bedstraw)

Geum rivale **54**
(Purple Avens)

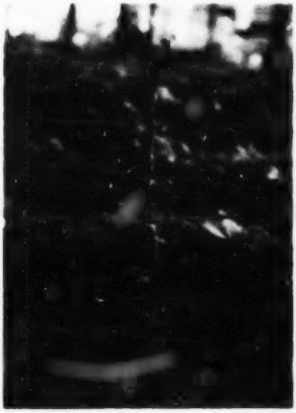


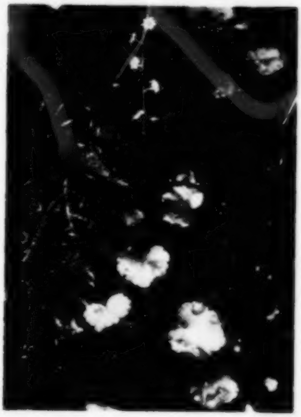
photo: W.J. Meades

Goodyera repens **55**
(Dwarf Rattlesnake-Plantain)

Habenaria dilatata **56**
(Scent-Bottle)

Listera convallarioides **57**
(Broad-Lipped Twayblade)

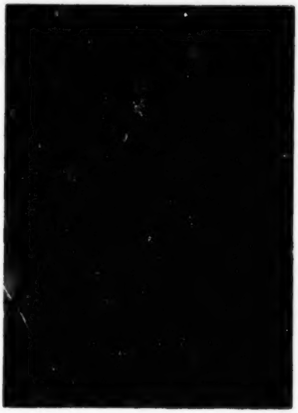
Listera cordata **58**
(Heartleaf Twayblade)



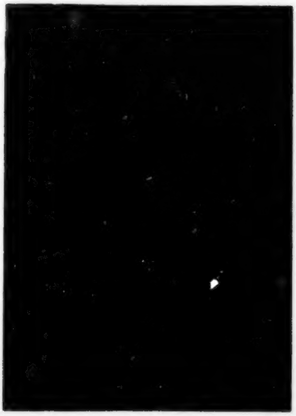
Mitella nuda **59**
(Naked Mitrewort)

Moneses uniflora **60**
(One-Flowered Wintergreen)

Rubus chamaemorus **61**
(Bake-Apple)



Rubus pubescens **62**
(Dewberry)



Sanguisorba canadensis **63**
(Bottlebrush)

Senecio aureus **64**
(Golden Ragwort)

Smilacina trifolia **65**
(Three-Leaved Solomon's Seal)

Solidago macrophylla **66**
(Large-Leaved Goldenrod)

Solidago rugosa **67**
(Rough-Stemmed Goldenrod)

Streptopus amplexifolius **68**
(Twisted-Stalk)

Streptopus roseus **69**
(Twisted-Stalk)

Viola cucullata **70**
(Blue Marsh Violet)

Viola incognita **71**
(Large-Leaved White Violet)

(also pictured: *Smilacina trifolia* 63)

Campylium polygamum **72**

MOSSES

Dicranum majus **73**

Dicranum polysetum **74**

Dicranum scoparium **75**
(Broom Moss)

Hylocomium splendens **76**
(Stair-Step Moss)

MOSSES

Hylocomium umbratum **77**

Mnium punctatum **78**

Pleurozium schreberi **79**

Ptilium crista-castrensis **80**
(Plume Moss)

Rhytidiadelphus loreus **81**

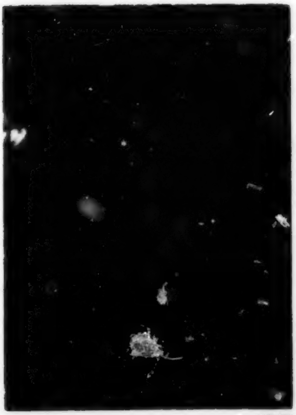
Rhytidiadelphus squarrosus **82**

Rhytidiadelphus triquetrus **83**
(Shaggy Moss)

Thuidium recognitum **84**

Sphagnum girgensohnii **85**

Sphagnum russowii **86**



Sphagnum magellanicum **87**

Sphagnum papillosum **88**

MOSSES

Sphagnum nemoreum **89**

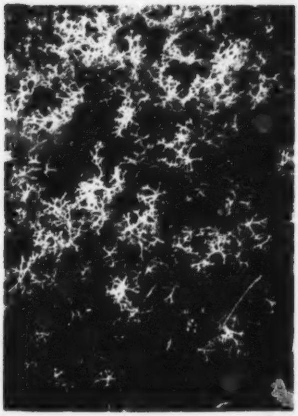
Sphagnum quinquefarium **90**

Sphagnum squarrosum **91**

Sphagnum carpet

Cladonia alpestris **92**

Cladonia arbuscula **93**
(Reindeer Moss)



Cladonia mitis **94**

Cladonia rangiferina **95**
(Reindeer Moss)

GLOSSARY

Achene: A dry, one-seeded fruit, not splitting open when mature.

Aeolian: Soil materials transported and deposited by wind action (also spelled Eolian).

Alluvial: Referring to parent materials deposited by rivers. Most extensively developed where the stream flow is checked.

Alternate: Referring to leaf arrangement, with one leaf at each node (attachment point) along the stem.

Arctic-alpine: Pertaining to plants whose distribution is usually beyond the northern tree limit or above treeline in mountainous areas.

Ascending: Curving upwards, often from a horizontal base.

Awn: A bristle-like extension on the lemma of grass flowers.

Axillary: Positioned in the axils, or angle between leaf and stem.

Axis: The main stem.

Beak: A prolonged tip.

Beard: A group or zone of hairs found on some petals (e.g. - violets)

Berry: A fleshy fruit with many small seeds. (e.g. - a Blueberry)

Biennial: Having a two-year life cycle; the first year producing leafy shoots, the second year producing flowers and fruits.

Bipinnate: Twice pinnately compound. A compound leaf or frond with each leaflet divided again into smaller leaflets.

Blade: The broad flat part of a leaf.

Bloom: A dull, whitish covering which can be rubbed off, occasionally found on fruit or leaves.

Bract: A small modified leaf usually at the base of a flower.

Branchlet: The final division of a branch; small branches coming off a larger branch.

Bristle: A stiff hair.

Calciphile: Plants that usually are restricted to calcareous soils with a neutral pH.

Capability: Mean annual increment in merchantable volume which can be expected for a forest area assuming it is fully stocked by one or more species best adapted to the site at or near rotation age.

Capsule: A dry fruit, splitting along two or more lines when mature.

Catkin: A dry scaly flower spike with petal-less male or female flowers (e.g. birch, aspen, willow).

Chronosequence: The complex of plant communities which can occur on a site, including the stable climax community and all other plant communities which develop after disturbance of the original community.

Ciliate: With short hairs on the margin of the leaf.

Clasping: Closely holding or surrounding the stem.

Cleft: Cut or deeply lobed.

Colluvial: Parent materials that have reached their present position by direct gravity-induced movement.

Column: A specialized structure in orchids formed by the fusion of the style and filaments, bearing the stigma and pollen sacs in a position to assure cross-pollination by the appropriate insect.

Compound: A leaf divided into several parts or leaflets (e.g. - Mountain Ash)

Continental: Referring to a regional climate characterized by extremely cold winters and relatively hot, dry summers.

Cordate: Heart-shaped at the base, tapering to the tip.

Corolla: All of the petals.

Costa: Midrib of moss leaves.

Disk: The central part of the flower head in daisy-like flowers; it bears small tubular, or disk, flowers.

Divergent: Spreading, pointing away from the stem or from other similar parts.

Downy: With fine hairs.

Drumlin: Till molded by an ice sheet into streamlined hills, elongated in the direction of the ice movement (cigar-shaped).

Drupe: A fleshy fruit with one or few hard stones, each surrounding one seed (e.g. - a Squashberry)

Ecoregion: A climatic region defined by a unique combination of vegetation toposequence, vegetation structure, floristic composition or plant distribution patterns.

Edaphic Grid: A two-dimensional graph illustrating the relationship between soil moisture and soil fertility.

Elliptic: Oval-shaped with tapering or pointed ends, widest at the middle.

Entire: Referring to leaf margins; even, not toothed or cut.

Erect: Pointed straight up; vertical.

Ericaceous: Plants belonging to the Heather Family (e.g. - *Kalmia, Ledum, Rhododendron, Vaccinium).*

Erodibility: The relative susceptability of a soil to movement, primarily by water and/or gravity.

Eskers: Winding ridges or stratified sediments deposited by streams that ran on, within, or beneath a glacier.

Eutrophic: Nutrient-rich sites, often with telluric seepage waters.

Fen: A meadow-like peatland formed from the accumulation of grasses and sedges. The nutrient status of the peat is strongly influenced by the quality of seepage waters entering from surrounding habitats.

Follicle: A dry fruit, splitting along one line when mature (e.g. - Marsh Marigold)

Forb: An herbaceous plant other than a grass or sedge.

Forest Type: A recurrent pattern of forest vegetation and soils that reacts similarly to disturbance and silvicultural treatment.

Fragipan: A subsoil layer of high bulk density, brittle when moist and very hard when dry. A fragipan does not soften on wetting, but can be broken in the hands. Air dry peds slake in water.

Gemma: A vegetative reproductive structure found in clubmosses (plural - gemmae)

Glacio - fluvial: Pertaining to parent materials that have been deposited either directly, or in front of, glacial ice. These deposits are usually older than fluvial deposits and hence exhibit better soil development. They include outwash plains, kames, kame terraces, and eskers.

Gleying: A process of soil development occurring under conditions of poor drainage and resulting in dull greyish soil colors. The colors are the result of the reduction of iron and other compounds.

Glumes: Two bracts found at the base of each grass spikelet.

Head: In daisy-like flowers: a dense cluster of many flowers surrounded by bracts at the base and with two types of flowers - small tubular fertile disk flowers in the center, and strap-shaped sterile ray flowers along the margin.
In sedges: A cluster of female flowers or perigynia.
In sphagnum: The cluster of short young branches at the top of the plant.

Heath: An oceanic or suboceanic vegetation dominated by ericaceous shrubs, usually growing on mineral soil of the podzolic order, but occasionally underlain by bedrock.

Indusium: A flap of tissue covering the sporangia of ferns (plural - indusia).

Inflorescence: A cluster of flowers.

Innundation: Periodic flooding by water.

Iron pan: a soil horizon (c) consisting of a very thin ribbon only 1 to 2 mm thick, with a reddish-black to very dusky red color and a metallic lustre. It is strongly cemented and impermeable. It overlies a rusty red, friable layer up to 1.0 cm thick. Its position in a podzolic profile is variable. Iron pans may occur under a gley horizon but never within a gley horizon.

Kames: Irregular, rounded, often cone- or dome-like hillocks of stratified drift deposited by melt water running off glacier sides or into melt-holes.

Keel: Folded longitudinally.

Krummholz: Wind-deformed trees usually occurring in the transition from timberline to the true alpine zone or northern tundra. Locally referred to as tuckamore or tuck.

Lanceolate: Lance-shaped; narrow, widest near the base and tapering to the tip.

Lateral: Positioned on the sides.

Leaflet: Subdivisions of a compound leaf.

Lemma: The outer of two bracts of a grass flower; often awned (the inner bract is the palea).

Linear: Long and narrow with parallel sides.

Margin: The edges of a leaf.

Mesotrophic: Moderately nutrient-rich sites (medium site).

Moisture Regime: The relative moisture available for plant growth over the growing season. It is relative to a given regional climate as represented by ecoregions. Within an ecoregion, variation of available moisture results from redistribution of precipitation by edaphic and topographic factors.

Moraine (Morainal): Material deposited directly by glacial ice. It is typically unsorted and contains a heterogeneous mixture of particles ranging from stones to clay; includes ground moraine, ablation moraine, terminal, and lateral moraines.

Mottled: Spots or blotches of different color or shade of color interspersed with the dominant soil color.

Nectary: A modified flower part that secretes nectar.

Node: The position on the stem where leaves are attached.

Nutlet: A small thick-walled fruit with one seed (e.g. - alders)

Oblanceolate: Inverted lance-shaped; narrow, widest near the tip, tapering to the base.

Oblique: In reference to leaves: attached at different levels, the leaf blade on each side of the midrib ending at different levels (e.g. *Sambucus*).

Oblong: Rectangular-shaped with rounded ends, of nearly uniform width throughout.

Obovate: Inverted egg-shaped; broad, widest near the tip and tapering to the base.

Oceanic: Pertaining to a regional climate characterized by mild winters and cold, damp summers.

Oligotrophic: Nutrient-poor habitats with nutrient input solely from precipitation (ombrotrophic) or from seepage waters that are low in minerals.

Opposite: Referring to leaf arrangement; with two leaves attached across from each other at each node of the stem.

Ovoid: A 3-dimensional oval-shape, widest at the base.

Palea: The inner of two bracts of a grass flower (the outer bract is the lemma).

Palmate: With several leaflets or leaf veins radiating from a common point.

Panicle: A branched flower cluster with each branch divided into several sub-branches.

Parent Material: The surficial geological material (mineral or organic) from which the soil has developed, unaltered by pedogenic processes. Most frequently the C soil horizon.

Perched Water Table: Referring to an elevated water table; usually within the rooting zone of trees for most of the growing season. Gravitational water movement is impeded by bedrock, various pans or very compacted till layers.

Perigynium: A modified sac-like bract which surrounds the achene in sedges (plural - perigynia).

Petiole: The leaf stalk, attaching the leaf blade to the stem.

Pinna: One of several divisions of a fern frond, each attached to the main axis (plural - pinnae).

Pinnate: A compound leaf with leaflets or pinnae attached along each side of the axis.

Pinnule: One of several subdivisions of a pinnae.

Pistil: The female part of the flower, composed of ovary at the base, a style, and a stigma at the tip.

Raceme: An elongate inflorescence with many stalked flowers attached along an upright axis.

Ray: A type of flower found on the outer margins of the flower head in daisy-like flowers. The petals are fused into one strap-shaped lobe, and thus appear to be one petal.

Reflexed: Bent downward or backward from the base.

Reticulate: Net-like.

Samara: A winged dry fruit with one seed. The fruit does not split open (e.g. - maples).

Seepage: Water passing laterally and downslope through the soil, usually associated with an impervious pan or bedrock.

Seral: Transitional plant community which occurs on a disturbed site prior to climax

Sessile: Attached directly to the stem, without a petiole or flower stalk.

Sheath: That portion of a sedge or grass leaf that surrounds the stem.

Siltation: The deposition of silt-size particles, usually from surface runoff, into rivers and lakes.

Simple: Referring to a leaf that is not divided or cut to the main axis (e.g. - alders or maples)

Site Index: An expression of forest site quality based on the height, at a specified age, of dominant and codominant trees in a forest stand.

Smooth: Not hairy.

Soil Series: A subdivision of soil families based upon relatively detailed properties of the pedon within the depth of the control section.,

Sorus: A cluster of sporangia on fern fronds (plural - sori).

Spike: An elongate inflorescence with many sessile flowers attached along an upright stem.

Spikelet: The inflorescence of a grass, composed of one to several flowers, the group subtended by two glumes.

Sporangia: The spore-containing structures of ferns and clubmosses.

Sporophyte: The spore-producing structure of mosses; composed of a capsule on top of a stalk.

Spreading: Pointing outward from the axis.

Spur: A tubular extension of a flower petal (e.g. - As in violets or *Habenaria*).

Squarrose: Bent backward sharply from the middle.

Stamen: The male reproductive structure of a flower. Usually with pollen in anthers at the end of a long filament.

Stigma: The pollen-receptive tip of the pistil.

Strobilus: A cone-like fruiting structure bearing spores (e.g. - As in clubmosses or horsetails) (plural - strobili).

Style: The portion of the pistil between the ovary and the stigma.

Subtending: Attached at the base.

Succession: A process of change whereby plant, animal and microbial populations replace each other and alter the environment in which they live.

Terminal: Positioned at the end of a stem or branch.

Till: Unsorted and unstratified glacial drift deposited by ice action.

Toposequence: The relationship between soil and vegetation types considered to be primarily due to relief.

Tripinnate: Three times pinnately compound leaf or frond, with each leaflet or pinna divided two more times into smaller sub-divisions (e.g. - Spinulose Wood Fern).

Undulate: Wavy or rippled.

Unequal: Of different lengths.

Venation: The arrangement of leaf veins.

Whorled: Referring to a leaf arrangement with three or more leaves attached at each node.

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APPENDIX A

INDEX TO ABBREVIATIONS USED IN THE FACT SHEETS

Abbreviations and fact sheet numbers for the forest types are listed at the beginning of this appendix. Following the forest types, all other abbreviations are listed under the headings they are used with in the fact sheets. Headings are arranged in appropriate order of: alphabetical, numerical, or lowest to highest. Further explanation of the abbreviations or categories can be found on the page, figure or table given in parentheses after each heading.

1. **Forest types:** abbreviation, name and fact sheet number (see Chapter 3)

Aa - Alluvial-Alder Swamp (not described)
Ac - Carex-Alder (not described)
AL - Lycopodium-Alder Swamp (#31)

Bd - Dryopteris-Birch (#28)
Bdc - Dryopteris-Clintonia-Birch (#25)
BK - Kalmia-Birch (#29)
BmA - Mountain-Alder-Birch (#26)
Br - Rubus-Birch (#27)
Bt - Birch Thickets (#32)
BtA - Birch-Aspen (#24)

Fa - Alder-Balsam Fir (not described)
Fc - Clintonia-Balsam Fir (#3)
Fd - Dryopteris-Balsam Fir (#6)
Fdh - Dryopteris-Hylocomium-Balsam Fir (#5)
Fdl - Dryopteris-Lycopodium-Balsam Fir (#8)
Fdr - Dryopteris-Rhytidiadelphus-Balsam Fir (#7)
Fg - Gaultheria-Balsam Fir (#10)
Fh - Hylocomium-Balsam Fir (#9)
Fp - Pleurozium-Balsam Fir (#11)
Fr - Rubus-Balsam Fir (#2)
Fre - Equisetum-Rubus-Balsam Fir (#1)
Fs - Sphagnum-Balsam Fir (not described)
Ft - Taxus-Balsam Fir (not described)
Fv - Vaccinium-Balsam Fir (not described)

K - Kalmia Heath (#33)

Mc - Carex-Mountain Maple (not described)
Mg - Galium-Mountain Maple (#30)

SA - Alder-Black Spruce (not described)
Sc - Carex-Black Spruce (#18)
SK - Kalmia-Black Spruce (#20)
SKc - Cladonia-Kalmia-Black Spruce (#21)
SKn - Nemopanthus-Kalmia-Black Spruce (#22)
SKs - Sphagnum-Kalmia-Black Spruce (#23)
SKt - Kalmia-Black Spruce-*Taxus* variant (not described)
SM/B - Black Spruce-Feathermoss/Bog (#16)
SM/D - Black Spruce-Feathermoss/Dry (#15)
SM/M - Black Spruce-Feathermoss/Moist (#17)
SM/R - Black Spruce-Feathermoss/Bedrock (#13)
SM/vD - Black Spruce-Feathermoss/Very Dry (#14)
SO - Osmunda-Black Spruce (#19)
Ss - Sphagnum-Black Spruce (#12)

2. **CLI Subclasses** (see p. 2-7, Table 1)

limitations due to:

C - a combination of local climatic conditions
D - restriction of rooting zone by dense or consolidated soil layers
E - actively eroding soils
F - low soil fertility
M - soil moisture deficiency
P - excessive stoniness
R - restriction of rooting zone by bedrock
S - a combination of soil factors
U - climatic exposure
W - soil moisture excess

3. **Compaction Hazard** (see p. 2-11, Table 3)

L - low
M - moderate
H - high

4. **Edaphic Grid** (see p. 2-4)

soil fertility:

VP - very poor
P - poor
M - medium
R - rich
VR - very rich

4. cont'd. ...

soil moisture:

0 - very dry
1 - dry
2 - well drained
3 - somewhat moist
4 - moist
5 - somewhat wet
6 - wet

5. **Frost Heave Hazard** (see p. 2-19, Figure 4)

L - low
M - moderate
H - high

6. **Harvesting Sensitivity** (see p. 2-14, Table 5)

0 - none
1 - low
2 - moderate
3 - high
4 - very high
5 - extreme

7. **Moisture Regime** (see p. 5-9, Table 21)

θ - extremely dry
0 - very dry
1 - dry
2 - well drained
3 - somewhat moist
4 - moist
5 - somewhat moist
6 - wet
7 - very wet

8. **Natural Regen-Potential** (see p. 2-18)

L - low
M - moderate
H - high

9. **Productivity** (see p. 2-6)

CLI Subclasses - see list 2 above
EST - estimated site index: extrapolated from sampled types
SI 50 (B.h.) m - site index in meters, breast height age 50 yrs.

Tree Species:

bF - Balsam Fir
bS - Black Spruce
wS - White Spruce
rP - Red Pine
tL - Eastern Larch

10. **Road Suitability** (see p. 2-17, Table 7)

L - low
M - moderate
H - high

11. **Soil Profile** (see p. 2-3, Figure 2 or p. 5-6, Table 19)

12. **Soil Types** (see p. 5-1)

13. **Species Suitability** (see p. 2-17)

LD - least desirable
S - satisfactory
MD - most desirable

Tree Species:

bS - Black Spruce
wS - White Spruce
L - Larch
P - Pine
bF - Balsam Fir
yB - Yellow Birch
tL - Eastern Larch

14. **Succession** (see p. 2-5, Figure 3)

Forest Types - see list at beginning of Appendix A

NC - no change
NSR - not sufficiently restocked
X - not applicable

15. **Trafficability** (see p. 2-17, Table 6)

O - none
L - low
M - moderate
H - high

16. **Vegetation Competition Hazard** (see p. 2-18)

X - none
L - low
M - moderate
H - high

Plant Species:

wB - White Birch
tA - Trembling Aspen
pC - Pin Cherry
mM - Mountain Maple
A - Alder
R - Raspberry
K - Kalmia
G-S - Grasses and Sedges

17. **Windthrow Hazard** (see p. 2-20, Figure 5)

L - low
M - moderate
H - high

APPENDIX B

INDEX TO COMMON NAMES OF THE PLANT SPECIES

Alder, Mountain	*Alnus crispa* (3)
Alder, Speckled	*Alnus rugosa* (4)
Alder-leaved Buckthorn	*Rhamnus alnifolia* (9)
Arbutus, Trailing	*Epigaea repens* (23)
Aster, Purple-stemmed	*Aster puniceus* (46)
Avens, Purple	*Geum rivale* (54)

Bake-apple	*Rubus chamaemorus* (61)
Baneberry, Red	*Actaea rubra* (44)
Bedstraw, Sweet-scented	*Galium triflorum* (53)
Beech-Fern, Long	*Dryopteris phegopteris* (28)
Bilberry, Oval-leaved	*Vaccinium ovalifolium* (19)
Blue-joint	*Calamagrostis canadensis* (37)
Blue Marsh Violet	*Viola cucullata* (70)
Blueberry, Low Bush	*Vaccinium angustifolium* (18)
Bottlebrush	*Sanguisorba canadensis* (63)
Bracken Fern	*Pteridium aquilinum* (33)
Bristly Black Currant	*Ribes lacustre* (13)
Bristly Clubmoss	*Lycopodium annotinum* (35)
Broad-lipped Twayblade	*Listera convallarioides* (57)
Broom Moss	*Dicranum scoparium* (75)
Buckthorn, Alder-leaved	*Rhamnus alnifolia* (9)

Canadian Yew	*Taxus canadensis* (17)
Cinnamon Fern	*Osmunda cinnamomea* (32)
Clintonia, Yellow	*Clintonia borealis* (49)
Clubmoss, Bristly	*Lycopodium annotinum* (35)
Clubmoss, Shining	*Lycopodium lucidulum* (36)
Clubmoss, Stiff	*Lycopodium annotinum* (35)
Cranberry, Highbush-	*Viburnum trilobum* (22)
Creeping Snowberry	*Gaultheria hispidula* (24)
Currant, Bristly Black	*Ribes lacustre* (13)
Currant, Skunk	*Ribes glandulosum* (11)
Currant, Swamp Red	*Ribes triste* (14)

Dewberry	*Rubus pubescens* (62)
Dogwood, Red-Osier	*Cornus stolonifera* (5)
Dwarf Enchanter's Nightshade	*Circaea alpina* (48)
Dwarf Rattlesnake-Plantain	*Goodyera repens* (55)

Elderberry, Red	*Sambucus pubens* (16)
Enchanter's Nightshade, Dwarf	*Circaea alpina* (48)
Evergreen Wood Fern	*Dryopteris spinulosa* var. *intermedia* (31)

Fern, Bracken	*Pteridium aquilinum* (33)
Fern, Cinnamon	*Osmunda cinnamomea* (32)
Fern, Evergreen Wood	*Dryopteris spinulosa* var. *intermedia* (31)
Fern, Lady	*Athyrium filix-femina* (25)
Fern, Long Beech-	*Dryopteris phegopteris* (28)
Fern, Mountain Wood	*Dryopteris spinulosa* var. *americana* (30)
Fern, New York	*Dryopteris noveboracensis* (27)
Fern, Oak	*Dryopteris disjuncta* (26)
Fern, Spinulose Wood	*Dryopteris spinulosa* var. *typicum* (29)

Golden Ragwort	*Senecio aureus* (64)
Goldenrod, Large-leaved	*Solidago macrophylla* (66)
Goldenrod, Rough-stemmed	*Solidago rugosa* (67)
Goldthread	*Coptis groenlandica* (50)
Gooseberry, Smooth	*Ribes hirtellum* (12)
Grass, Hair	*Deschampsia flexuosa* (39)
Grass, Rattlesnake	*Glyceria canadensis* (40)

Hair Grass	*Deschampsia flexuosa* (39)
Heartleaf Twayblade	*Listera cordata* (58)
Highbush-Cranberry	*Viburnum trilobum* (22)
Holly, Mountain	*Nemopanthus mucronata* (8)
Horsetail, Woodland	*Equisetum sylvaticum* (34)

Labrador Tea	*Ledum groenlandicum* (7)
Lady Fern	*Athyrium filix-femina* (25)
Lady-slipper, Showy	*Cypripedium reginae* (51)
Large-leaved Goldenrod	*Solidago macrophylla* (66)
Large-leaved White Violet	*Viola incognita* (71)
Laurel, Sheep	*Kalmia angustifolia* (6)
Long Beech-Fern	*Dryopteris phegopteris* (28)
Low Bush Blueberry	*Vaccinium angustifolium* (18)

Maple, Mountain	*Acer spicatum* (2)
Maple, Red	*Acer rubrum* (1)
Marsh-Marigold	*Caltha palustris* (47)
Mayflower	*Epigaea repens* (23)
Mitrewort, Naked	*Mitella nuda* (59)

Moss, Broom	*Dicranum scoparium* (75)
Moss, Plume	*Ptilium crista-castrensis* (80)
Moss, Reindeer	*Cladonia rangiferina* (95)
Moss, Reindeer	*Cladonia arbuscula* (93)
Moss, Shaggy	*Rhytidiadelphus triquetrus* (83)
Moss, Stair-Step	*Hylocomium splendens* (76)
Mountain Alder	*Alnus crispa* (3)
Mountain Holly	*Nemopanthus mucronata* (8)
Mountain Maple	*Acer spicatum* (2)
Mountain Wood Fern	*Dryopteris spinulosa* var. *americana* (30)
Naked Mitrewort	*Mitella nuda* (59)
New York Fern	*Dryopteris noveboracensis* (27)
Oak Fern	*Dryopteris disjuncta* (26)
One-flowered Wintergreen	*Moneses uniflora* (60)
Oval leaved Bilberry	*Vaccinium ovalifolium* (19)
Plume Moss	*Ptilium crista-castrensis* (80)
Purple Avens	*Geum rivale* (54)
Purple-stemmed Aster	*Aster puniceus* (46)
Ragwort, Golden	*Senecio aureus* (64)
Raisin, Wild	*Viburnum cassinoides* (20)
Raspberry, Wild	*Rubus idaeus* (15)
Rattlesnake Grass	*Glyceria canadensis* (40)
Rattlesnake-Plantain, Dwarf	*Goodyera repens* (55)
Red Baneberry	*Actaea rubra* (44)
Red Elderberry	*Sambucus pubens* (16)
Red Maple	*Acer rubrum* (1)
Red-Osier Dogwood	*Cornus stolonifera* (5)
Reedgrass, Wood	*Cinna latifolia* (38)
Reindeer Moss	*Cladonia arbuscula* (93)
Reindeer Moss	*Cladonia rangiferina* (95)
Rhodora	*Rhododendron canadense* (10)
Rough-stemmed Goldenrod	*Solidago rugosa* (67)
Sarsaparilla, Wild	*Aralia nudicaulis* (45)
Scent-bottle	*Habenaria dilatata* (56)
Shaggy Moss	*Rhytidiadelphus triquetrus* (83)
Sheep Laurel	*Kalmia angustifolia* (6)
Shining Clubmoss	*Lycopodium lucidulum* (36)
Showy Lady-slipper	*Cypripedium reginae* (51)
Skunk Currant	*Ribes glandulosum* (11)
Smooth Gooseberry	*Ribes hirtellum* (12)

Snowberry, Creeping	*Gaultheria hispidula* (24)
Solomon's Seal, Three-leaved	*Smilacina trifolia* (65)
Speckled Alder	*Alnus rugosa* (4)
Spinulose Wood Fern	*Dryopteris spinulosa* var. *typicum* (29)
Squashberry	*Viburnum edule* (21)
Stair-Step Moss	*Hylocomium splendens* (76)
Stiff Clubmoss	*Lycopodium annotinum* (35)
Swamp Red Currant	*Ribes triste* (14)
Sweet-scented Bedstraw	*Galium triflorum* (53)
Tea, Labrador	*Ledum groenlandicum* (7)
Three-leaved Solomon's Seal	*Smilacina trifolia* (65)
Trailing Arbutus	*Epigaea repens* (23)
Twayblade, Broad-lipped	*Listera convallarioides* (57)
Twayblade, Heartleaf	*Listera cordata* (58)
Twisted-stalk	*Streptopus amplexifolius* (68)
Twisted-stalk	*Streptopus roseus* (69)
Violet, Blue Marsh	*Viola cucullata* (70)
Violet, Large-leaved White	*Viola incognita* (71)
Wild Raisin	*Viburnum cassinoides* (20)
Wild Raspberry	*Rubus idaeus* (15)
Wild Sarsaparilla	*Aralia nudicaulis* (45)
Wintergreen, One-flowered	*Moneses uniflora* (60)
Wood Fern, Evergreen	*Dryopteris spinulosa* var. *intermedia* (31)
Wood Fern, Mountain	*Dryopteris spinulosa* var. americana (30)
Wood Fern, Spinulose	*Dryopteris spinulosa* var. *typicum* (29)
Wood Reedgrass	*Cinna latifolia* (38)
Woodland Horsetail	*Equisetum sylvaticum* (34)
Yellow Clintonia	*Clintonia borealis* (49)
Yew, Canadian	*Taxus canadensis* (17)

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